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SECOND ANNUAL REPORT  
OF THE  
SECRETARY  
OF THE  
STATE BOARD OF HEALTH  
OF THE  
STATE OF MICHIGAN,  
FOR THE  
FISCAL YEAR ENDING SEPT. 30, 1874.



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BY AUTHORITY.

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LANSING:  
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Public Health  
Hff  
Henry F. Vaughan  
3-14-44

STATE OF MICHIGAN,  
OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH, }  
Lansing, November, 1874. }

TO JOHN J. BAGLEY, *Governor of Michigan* :

SIR:—In compliance with the laws of this State, I present to you the accompanying Report for the fiscal year ending September 30th, 1874.

Very respectfully,

HENRY B. BAKER,  
*Secretary of the State Board of Health.*





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# REPORT.

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The law establishing this Board, after specifying some of the several duties of its Secretary, says: "He shall collect information concerning vital statistics, knowledge respecting diseases, and all useful information on the subject of hygiene, and through an annual report, and otherwise as the Board may direct, shall disseminate such information among the people."

As regards the "information concerning vital statistics," the publication thereof has thus far been confined mainly to the regular Reports of the Secretary of State, on Births, Marriages, and Deaths, in accordance with another provision of law that "The Secretary of the State Board of Health shall be the Superintendent of vital statistics. Under the general direction of the Secretary of State, he shall collect these statistics and prepare and publish the report required by law relating to Births, Marriages, and Deaths." The results of this part of the labor of the Secretary are to be found in the Reports on the above mentioned subject.

This is the Second Annual Report of the Secretary of this Board, and is for the year ending September 30, 1874. In this Report the Board is able to publish the results of special investigations concerning a wide range of subjects closely connected with the life and health of the people of this State.

The nine special papers published in this Report, by members of the board, represent a portion of the gratuitous labor of the individual members who contribute them in the cause of public health. They are published in accordance with a resolution adopted October 14, 1873, as follows:

*"Resolved,* That no papers shall be published in the Annual Report of this board except such as are ordered or approved for purposes of such publication by a majority of the members of the board; and that any such paper shall be published over the signature of the writer, who is entitled to the credit of its production, as well as responsible for the statements of facts and opinions expressed therein."

Although, as yet, no paper has been offered to the board for publication, except by its members, it is believed that the work and reports of the board amply fulfill the prediction of those who memorialized the Legislature to pass the act for its establishment. One of those memorials contained the following:

*"WHEREAS,* It is uniformly the testimony of those best qualified to form correct opinions on this subject, that in every year hundreds and even thousands of persons in this State lose their lives, and that many others suffer severe losses in health, happiness, time, and money, from causes which might be removed, and these deaths and losses thus prevented, if the knowledge on this subject now possessed by the teachers of hygiene could be brought to bear directly upon the ordinary affairs of life;

*And whereas,* It is believed that a sufficient number of prominent teachers, and others

well skilled in the knowledge of public health, will undertake to accomplish this, and give their knowledge and services free towards preventing in some degree this great waste of human life and unnecessary suffering and expense, if only the means be placed at their disposal to render their efforts useful to the people," etc.

Without pretending that a "sufficient number" of those "well skilled in a knowledge of public health," have yet worked in this field, or that those who have thus worked have labored long enough to do away with all the ignorance in the way of preventing sickness and death, or that anything more than an excellent beginning has been made in this organized effort to search out the most important causes of death in order that they may be avoided, there is yet reason to believe that the dissemination, among the people, of the free contributions of members of the board has already prevented, and will continue to prevent "in some degree this great waste of human life."

As to the nine special papers in this Report, their titles may be seen in the table of contents, and their character will be learned through a study of the papers themselves. In each of them some facts are presented which have never before been thus stated or thus grouped. The first one in the order of publication is the Address of the President of the Board at the annual meeting in April, 1874. This paper, entitled the "Entailments of Alcohol," was published as a circular about the time of its delivery. It was distributed to each newspaper, public library, and library association within the State, and to persons interested in the public health. The paper concerning "Impurities and Adulterations in Table Syrups" has not been published before, although short abstracts were reported and published in various papers and journals soon after the meeting of the Board when it was presented. The paper entitled "Draining for Health" has not heretofore been published or abstracted. The one on "Poisonous Paper" is a condensation of several papers relating to this subject, by the same author, with some additions thereto. "The Relation of Schools to Health" has not been published previously. It was presented to the Board at its meeting in October. The paper on "Resuscitation of the Drowned" has not been previously published, but contains rules for the "Treatment of the Drowned," of which 13,000 copies have been printed and distributed throughout the State by this Board, and very many thousands more have been distributed through reprints therefrom by various newspapers and journals. The report relating to the "Sanitary Inspection of Certain State Institutions" has not been published before. The report on "Cerebro-Spinal Meningitis" has not been previously published, but an abstract of a preliminary report made to the Board at its meeting in July was published in some of the newspapers of this and other States, and even found its way to England, furnishing the subject of two columns of editorial remarks in the *London Lancet* for October, 1874. The paper would undoubtedly have been more valuable if the author could have included in his studies the material facts relative to this disease as it prevailed so extensively throughout this State in 1872-3. But this Board had not at that time been organized in working order. There was, therefore, no one whose business it was to collect such evidence as is essential to a study of the causes of the disease. The paper on the "Meteorology of Central Michigan" has not been previously published or abstracted. It was not originally intended for publication in this report, but was a lecture delivered at the Agricultural College. By request, Prof. Kedzie allows its publication herein. The subject is one of very great importance, partly for the reason that we do not yet understand the various ways in which climatic conditions and changes

cause death or serious illness, although we do know that such is the fact, many fatal diseases prevailing at certain warm seasons, and certain others during severe cold and dry seasons. Perhaps the time has not yet arrived, but if not it is rapidly approaching, when the "chief signal officer of the public health department" shall be able to make some such announcement as that, "because of the extreme dryness and coldness of the atmosphere all who expose themselves unduly thereto, and who do not provide against the danger by artificial moisture, as well as heat, in their rooms, are at this time in danger from inflammation of the lungs and from croup;" or "because of the great warmth and moisture of the atmosphere, there is now great danger to children from diarrheal diseases, especially in cities and places where there is not an abundance of pure fresh air." Warning signals might well be published concerning dangers to life and health through numerous other means than shipwreck, and through many others connected with meteorology. And this is only possible through the use of long series of accurately recorded observations, such as those included in the paper by Professor Kedzie.

In accordance with the law and plan of duties of the board, information bearing upon several subjects connected with the public health and the lives of the people, has been collected and disseminated otherwise than through this Annual Report. The regular meetings of the board have been open to reporters and others, and several important subjects that have as yet not been published otherwise, have received attention through the newspaper reports of the meetings at which they were presented. Different members of the board have also contributed communications to the newspapers of this State upon subjects connected with the public health, as, for instance, the communications by Prof. Kedzie relative to the sources of danger from the use of illuminating oils which at a low temperature give off a vapor that becomes explosive by being mixed with air, the danger from occupying rooms the walls of which are covered with paper having arsenical pigments upon it, etc. etc.

From the Journal of the Constitutional Commission of 1873, for the 34th day, Friday, October 10, 1873, I quote the following, relative to action taken by certain committees acting for this board:

"The Chairman laid before the Commission the following communication from the State Board of Health:

*Lansing, October 9, 1873.*

HON. S. M. CUTCHEON, *President of the Constitutional Commission:*

SIR—In this memorial the undersigned petitioners respectfully suggest that as for the individual man, one of the primary laws of nature is self-preservation, so, also, one of the first duties of the State is the protection of the lives and health of the people, and we ask your honorable body to consider the propriety of embodying in the proposed new Constitution some recognition of the principle sought to be expressed in the paragraph herewith respectfully submitted.

Very respectfully,

R. C. KEDZIE,  
HOMER O. HITCHCOCK,  
HENRY B. BAKER,

*Committee from the State Board of Health on "Legislation in the interests of Public Health."*

SEC. — The Legislature shall pass all laws necessary for the protection of the lives and health of the people; especially such laws as shall best guard the people from dangers to life and health which arise from the aggregation of persons in organized society, and which, as individuals, they are unable to avoid or control.

Mr. Wells presented to the commission the following memorial:

*Lansing, October 8, 1873.*

*To the Honorable Constitutional Commission:*

The undersigned, members of the State Board of Health, a committee of said board on "Poisons, explosives, chemicals, accidents, and special sources of danger to life and health," also a committee on "Legislation in the interests of public health," would respectfully petition the Constitutional Commission to embody in the organic law of the State, some safeguard for the lives and persons of our citizens, when traveling on railroads, steamboats, and other public carriers. The law ordains that "the State Board of Health shall have the general supervision of the interests of the life and health of the citizens of this State." Charged with so grave a responsibility, we trust that you will not consider us as officiously thrusting ourselves forward in thus calling your attention to causes which annually destroy the life, or dreadfully mutilate the persons of a large number of the citizens of this State. The duties assigned us by the law would seem to leave us no option in the case.

We need not bring before you in detail the list of such accidents. Every newspaper, almost, brings the report of sudden and violent death by railroad accidents, or steamers wrecked. The State Board of Health are convinced that many of these so-called accidents arise from preventable causes. A broken rail, or an unusual storm on the lakes, is often alleged as justifiable excuse for such accidents, and an inscrutable Providence is often held responsible for results springing from human recklessness. In our opinion, Providence should be relieved of much of this responsibility, and the guilty human agents should be held to a stern account by the law. A railroad track knowingly left in a dangerous condition, or a steamboat which leaves harbor in an unseaworthy condition, should not be charged to the account of Providence. The improvidence of man should not be charged to the Providence of God.

We recognize the propriety of those provisions in the organic law of the State that throw the strong arm of its sanction around vested rights, and give security to capital. But should not equal sanction be thrown around human life?

No one would accuse railroad directors or steamboat owners of a personal and wanton disregard for human life; but these forms of capital must trust the responsibility for the safety of the traveling public to its subordinates; these subordinates, from the nature of the case, are assigned to specified duties, and when any emergency arises, such officials too often will ask not, "Is there danger to life or person?" but "Is it my special duty to avert that danger?"—and thus shifting the responsibility on some other, perhaps absent, functionary, a train is left unwarned, to rush into the very jaws of death, or a steamboat founders within sight of port, with all its precious freight of human life.

The question arises, how shall we make railroad and steamboat lines, and other public carriers responsible for the destruction of life, and injury of person—such as would be visited with swift punishment if inflicted by an individual? We must demand from capital some security for the lives of those with respect to whom capital seeks employment; and in the opinion of this committee, the only feasible way is to hold capital responsible in the only way that capital can be influenced, viz., the *danger of loss*. Then capital will seek to guard itself from loss, and some assurance of safety will be given to the traveling public. We come before you to plead for the safety of the poor and unprotected against the rapacity of organized wealth. We would not undermine capital, but we would make life sacred.

We ask therefore your honorable body to embody in the Constitution a provision whereby the stockholders of any railroad, or steamboat, or other public carrier, shall forfeit some adequate sum of money for every life destroyed by preventable causes in their management, or by the carelessness or inefficiency of any of their employes.

If it should be objected that such action would be of the nature of special legislation, we would respectfully ask if any subject can be of more general interest than the protection of the lives and persons of our citizens. The question may arise, why not leave to the Legislature the enacting of laws for this protection of person and life? One reason for desiring the engrafting of such provision in the constitution, is that in enforcing such law, enacted by the Legislature, the question of its constitutionality would first have to be settled, and years of litigation might ensue before the law would have its full force. Some railroads at the east have said that they design to make litigation for securing personal rights so costly that no man would dare to go to law with a railroad; and thus justice is overborne by the insolence of money. By placing this provision in the constitution, the only question which would come before the courts would be those of fact, and not of the validity of the law.

We ask this action out of no hostility to railroad or steamboat lines, or other public carriers, but we ask it in the name of that enlightened humanity which holds life sacred

unless forfeited by crime. We beseech you not to permit the security of life to be small in order to make the dividends on capital large.

Respectfully submitted.

R. C. KEDZIE,  
H. O. HITCHCOCK,  
HENRY B. BAKER,

"Committee on Poisons, Explosives, Chemicals, Accidents, and Special Sources of Danger to Life and Health;" and "Committee on Legislation in the Interests of Public Health."

Soon after the annual meeting of the board in April, the President's Address was printed and distributed as a circular. About the same time a circular relative to the duties of local boards of health, proper proceedings in case of outbreak of contagious or infectious diseases, and giving information concerning disinfection, etc., was printed and distributed to the presidents of local boards of health, to the editors of newspapers, and to others interested in the promotion of the public health. The circular was prepared under the supervision of Dr. Z. E. Bliss, member of the board, and chairman of the committee on Epidemic, Endemic, and Contagious Diseases. It was as follows:

[CIRCULAR.]

MICHIGAN STATE BOARD OF HEALTH, }  
Grand Rapids, April, 1874. }

To the President of the Local Board of Health:

SIR—This circular is issued for the purpose of respectfully calling the attention of local Boards of Health to the law and to their duties relative to *diseases dangerous to the public health*.

All "diseases dangerous to the public health" are greatly modified in character, and some of them largely preventable, through those agencies which ensure to a people air free from contamination with either the effluvia from animal, or the miasm from vegetable decomposition, and which also secure to them pure water and wholesome food.

To aid in securing these, so far as possible, is one of the first and constant duties of a local Board of Health.

Among the sources from which are generated active causes of disease and death, are the following: Slaughter-houses, soap-boiling factories, bone and fat-rendering establishments, tanneries, pig-sties, neglected privies and stables, filth-sodden grounds, putrescent animal or vegetable materials, filth from whatever source, foul cellars, imperfect water-closets, foul or obstructed sewers or house-drains, mill-ponds, swamps, marshes, cess-pools, stagnant water, imperfect ventilation of places of public resort, diseased meat, stale fish, impure milk, unripe fruit, decayed vegetables, adulterated food, and impure water;—the latter may be contaminated from too close a proximity to a privy-vault, or an imperfect sewer or house-drain, at other times by surface water.

It is the duty of a local Board of Health to remove, as effectually as possible, all local causes of disease, by a thorough system of inspection, of disinfection, and by the reconstruction, or the condemnation and removal or destruction of the sources from which are generated these causes; and whenever there are reasons for expecting the possible visitation of a contagious or infectious disease, or during the prevalence of an epidemic or endemic disease, the obligation to remove these causes becomes imperative.

For the law relating to this subject you are referred to sections 1694, 1699, and 1737, Compiled Laws of 1871, which are as follows:

"(1694.) SEC. 8. The board of health shall make such regulations respecting nuisances, sources of filth, and causes of sickness within their respective townships and on board of any vessels in their ports or harbors as they shall judge necessary for the public health and safety; and if any person shall violate any such regulations he shall forfeit a sum not exceeding one hundred dollars."

"(1699.) SEC. 8. The board of health shall examine into all nuisances, sources of filth, and causes of sickness that may, in their opinion, be injurious to the health of the inhabitants within their township, or in any vessel within any harbor or port of such township; and the same shall destroy, remove, or prevent, as the case may require."

"(1737.) SEC. 46. The township board of every township, the president and trustees, or council of every village, and the mayor and aldermen of every city, respectively, when they shall judge it necessary, shall, from time to time, assign certain places for the exercising of



any trade or employment offensive to the inhabitants or dangerous to the public health; and they shall forbid the exercise thereof in places not so assigned; and all such assignments shall be entered in the records of the township, village, or city, and they may be revoked when the said township, village, or city officers may think proper."

It is recommended that every local Board of Health, which has not already done so, appoint a competent physician as health officer, in accordance with section 1693, Compiled Laws of 1871; and further, that they urge upon the people of their township to make permanent provision for the vaccination of all persons within their jurisdiction, free of charge, in accordance with section 1736, Compiled Laws of 1871, and Boards of Health of cities and incorporated villages are recommended to secure similar action in reference to vaccination.

#### SMALL-POX AND OTHER CONTAGIOUS AND INFECTIOUS DISEASES.

Sections 1734 and 1735, Compiled Laws of 1871, are as follows:

"(1734.) SEC. 43. Whenever any householder shall know that any person within his family is taken sick with the small-pox, *or any other disease dangerous to the public health*, he shall immediately give notice thereof to the Board of Health or to the health officer of the township in which he resides; and if he shall refuse or neglect to give such notice, he shall forfeit a sum not exceeding one hundred dollars."

"(1735.) SEC. 44. Whenever any physician shall know that any person whom he is called to visit is infected with the small-pox, *or any other disease dangerous to the public health*, such physician shall immediately give notice thereof to the board of health or health officer of the township in which such diseased person may be; and every physician who shall refuse or neglect to give such notice, shall forfeit, for each offense, a sum not less than fifty nor more than one hundred dollars."

No definite form of notification is prescribed by law, but it is requested the one be used which is recommended by the State Board of Health in circular No. 2, a copy of which is herewith given; and to ensure a more certain and perfect compliance with the law, it is recommended that every local Board of Health keep a supply of these blank notifications for distribution among physicians, and when necessary to citizens.



The sure means of arresting the spread of small-pox are vaccination of the people, isolation of the infected person, absolute quarantine of the household or hospital where the diseased person is lying, cleanliness, ventilation, disinfection of all excreta from the infected; and, after the termination of the case, either the thorough disinfection of all clothing, bedding, carpets, window-hangings, etc., or their destruction, and the disinfection of the furniture, upholstery, and room or apartments and building in which the infected person has been lying.

For the law upon quarantine, not already noticed, you are referred to sections 1718 to 1725 inclusive, of Compiled Laws of 1871, and for the law referring to small-pox and other dangerous diseases not heretofore noticed in this circular, you are referred to section 1695, sections 1706 to 1715 inclusive, and sections 1726 to 1733 inclusive, of Compiled Laws of 1871.

SCARLET FEVER is a *contagious or infectious* disease, and as such requires the same means of prevention as *small-pox* (except vaccination), including "isolation of the infected person, absolute quarantine of the household or hospital where the diseased person is lying, cleanliness, ventilation," and all the methods of disinfection hereinafter enumerated, in connection with the disinfection of excreta from the infected, the disinfection of clothing, bedding, furniture, and rooms, and also fumigation. When *scarlet fever* exists in a community the preventive means should be applied with the same energy and perseverance as is done during the prevalence of *small-pox*.

The number of deaths in Michigan during the year 1870 from *small-pox* were nine (9); from *scarlet fever*, eight hundred and fifty-two (852). If it is worth while to attempt to decrease the number of deaths from *small-pox* below nine (9) a year is it not an imperative duty to reduce the number of deaths from *scarlet fever* from 852 a year to a number that will, in a measure, approximate that of deaths from other *contagious and infectious* diseases?

Besides these 852 persons who died of scarlet fever during the year 1870, there remain living, hundreds of those who struggled through the painful stages of this frequently destructive disease, and are left with partial and permanent deafness, and with constitutions hopelessly impaired.

There are those who believe that scarlet fever is not contagious, because many persons exposed do not contract the disease, and also because this disease sometimes makes its appearance almost simultaneously in different localities widely separated from each other.

It is answered that the same may be said of *cholera*. Yet, would persons unnecessarily expose themselves to *cholera*?

The practice of friends and neighbors collecting at the residence of an infected family to attend the funeral services of a person who has died of this disease should be prohibited, for while adults may enter such a dwelling with comparative immunity to themselves, the disease being usually one of childhood, they *may* and frequently *do* carry the *poisonous infection* from the diseased family into their own homes, where it attacks and frequently destroys their children. Many instances of this kind occur every year. Hundreds of deaths will annually occur in this State from this disease unless measures are taken to prevent its spread by contagion.

MEASLES.—The number of deaths from this disease in Michigan during the year 1869 was one hundred and forty-seven (147), and during the year 1870 fifty-six (56). The same preventive measures already enumerated for scarlet fever are applicable to this disease, and if enforced would lessen the number of cases and the mortality become proportionately reduced.

TYPHOID FEVER.—Whether this be considered a contagious or infectious disease, or both under favoring conditions, whenever it exists every precaution should be used to prevent its attacking the different members of a household, or the people of a neighborhood. Besides using the methods of prevention for infectious diseases, examine into the condition of the air and water supply of the persons affected, as many cases are believed to result from contamination of the atmosphere or water used, by gas or matter from decomposing animal refuse. If the source can be found, methods for preventing the further spread of the disease will be readily suggested.

#### DISINFECTANTS AND METHODS OF DISINFECTION.

Ten pounds of sulphate of iron (copperas) dissolved in six gallons of water, with half a pint of crude carbolic acid added to the solution, and briskly stirred, makes a cheap and excellent disinfecting fluid for common use. If the carbolic acid is not at hand, the solution of copperas may be used without it.

To prevent infection or offensiveness of privies, water closets, sewers, drains, and ditches, pour a pint of this strong solution into these receptacles once or twice daily, and to disinfect masses of filth in them, gradually pour in this solution until it reaches and disinfects all the foul material. Add enough of this solution to every evacuation of excreta from

the infected person, to thoroughly disinfect every part of it. Keep a quantity of this disinfecting fluid in the chamber-vessel.

An excellent disinfecting fluid for chamber-vessels may be prepared by dissolving either two ounces of the chloride of lime, or two ounces of the chloride of zinc, or eight ounces of crude carbolic acid, in a gallon of water.

Dry charcoal, in fine pieces, is a most valuable disinfectant. A panful, or its equivalent in amount, should be kept in every sick-room.

Cellars which cannot be ventilated should have a quantity of this article placed in them. Charcoal will retain its disinfecting powers many months,—even years,—if kept dry. For disinfecting *extensive masses or surfaces of putrescent materials*, use either coarsely powdered charcoal, the disinfecting fluid first above mentioned, or “dead oil” (“heavy oil”) of coal-tar, or coal-tar itself. Coal-tar may be used as a paint upon the walls of cellars, stables, and open drains.

White-washing with quick-lime should be practiced in common tenements, factories, basements, closets, and garrets. To disinfect clothing, bedding, and other materials capable of like treatment, throw them into a solution made as follows: One pound of chloride of zinc, six ounces of crude carbolic acid, and eight gallons of water, such articles to remain therein until thoroughly saturated with the liquid; then immediately place them in boiling water, and continue boiling for one hour. To disinfect rooms, apartments, and buildings, either paint or wash all wood-work, adding either two ounces of the chloride of zinc, or two ounces of the chloride of lime, or four ounces of crude carbolic acid, to every gallon of water. Soap should not be used with chloride of zinc or chloride of lime. The walls and ceilings of rooms should be first washed with the above-mentioned solution. They can then be either kalsomined, whitewashed or papered. If kalsomined, add to every gallon of the kalsomining liquid, either one-fourth pound of the chloride of zinc, or four ounces of crude carbolic acid. If the walls or ceilings are already papered, strip them of the paper on them; then apply the methods of cleansing already given.

#### GASEOUS DISINFECTION, OR FUMIGATION.

These, like other disinfectants, arrest the processes of fermentation, of putrefaction, and of the generation of infection, while they seem to destroy infection which is mature.

**SULPHUROUS ACID GAS.**—To fumigate with this, close all the openings of the room and arrange the upholstery, and spread out the other articles to be disinfected, so as to expose the greatest amount of surface to the action of the fumes; take a pan, or other metallic vessel, put some ashes in it, place a few live coals on the ashes, throw on to the coals a handful of sulphur (it requires the thorough combustion of nearly one and a half ounces of sulphur to disinfect one hundred cubic feet of air), place the vessel on the floor, and retiring from the room, close the door. Let the room remain closed from six to eight hours; then secure free ventilation by opening the doors and windows, being careful while doing so not to inhale any of the sulphurous vapors, and ventilate the room until all sulphurous odors disappear.

**CHLORINE GAS.**—To fumigate with this, proceed as before, and generate the gas by adding sulphuric acid to a mixture of common salt and peroxide of manganese (which can be obtained at any drug store), first adding a little water to the mixture before pouring on the acid. If used in rooms containing colored goods, the colors may be sacrificed by the bleaching properties of chlorine, but it is one of the best gaseous disinfectants.

**SHIPS, DISINFECTION OF.**—Besides the use of methods heretofore given, secure cleanliness of all places within reach, and continue to do so throughout the unloading of the vessel; procure ventilation by open hatches and “wind sails.” Bilge-water should be pumped out daily, and before discharging a vessel as clean, water should be thrown down the pumps, left over night, then pumped out, and this process continued until the water comes up clear. In the case of an “infected ship,”—as shown by cases of infectious disease appearing among persons on shipboard while at sea, and after an absence from land of too long a time for the incubating period of the disease,—besides subjecting the vessel to the disinfecting processes before mentioned, the wood-work should be repainted and the unpainted wood-work whitewashed.

The visitation of many of the “diseases dangerous to the public health” may be prevented by timely warning of their approach; and in view of the possible appearance of cholera in the West in the present year, increased vigilance is recommended on the part of Health Boards, especially those whose jurisdiction includes lake ports, railroad centres, the borders of navigable streams, railroad lines, or public thoroughfares.

If any contagious or infectious disease should exist, or any endemic or epidemic prevail within your jurisdiction, please immediately notify the State Board of Health, and also

carefully note the rise, progress, and decline of any such diseases, and the conditions existing during such times.

By direction of the State Board of Health.

Very respectfully,

Z. E. BLISS, M. D.,  
*Chairman of Committee on Epidemic, Endemic, and Contagious Diseases.*

In accordance with the action of the board in July last, about one hundred Books of Specimens of Poisonous Papers were prepared under the direction of the Committee on Poisons, etc., and distributed by the Secretary to the leading public libraries throughout this State. Each book contained a large number of specimens of such poisonous paper as is constantly offered for sale, and purchased, throughout the State; the rolls of wall-paper, of which the books included samples, having been selected by Prof. Kedzie from those kept for sale at Jackson, Lansing, and Detroit. The circular giving notice of the transmittal of the volume was as follows:

STATE BOARD OF HEALTH, MICHIGAN, }  
OFFICE OF SECRETARY, }  
*Lansing, November, 1874.* }

*To the Librarian:*

By direction of the State Board of Health, I send you by this mail a book of specimens of poisonous papers.

These papers have been collected in this State by Prof. R. C. Kedzie, a member of the State Board of Health. Each sample has been examined by him and found to contain arsenic.

These books of specimens are distributed to the leading public libraries throughout this State, in the hope that by so doing the people will be more effectually warned of this source of danger to health, which is believed to be more general than is usually understood by the people.

By giving this book a prominent place in your library, you will further the objects which the board have in view.

The poisonous nature of the paper of which this book is made will suggest to you the propriety of not allowing it to be handled by children.

Very respectfully,

HENRY B. BAKER, M. D., *Secretary.*

The printed matter contained in the books of specimens of poisonous papers was also published in the form of an eight-page pamphlet, and quite thoroughly distributed among the people. Several cases of illness fairly attributable to poisonous papers have been discovered through the influence of the work of this Board. I give the following as an example:

Jefferson Pierce, who resides at the corner of Capitol avenue and Jefferson street, in this city, had two rooms adjoining each other, papered with such paper as the sample presented to me, and which exhibited evidence of the presence of arsenic in considerable quantities when tested as directed by Prof. Kedzie. One room was a bedroom. The door between the two rooms was kept closed during the summer. Every time he left home for a few days he was free from distress in the pit of his stomach, which troubled him while he occupied that bedroom at home. After a time he had the bedroom paper varnished. This was in the summer, and he then had no further trouble until winter, when the door between the rooms was left open because of a fire in the larger room. His trouble then returned, and, in addition, he had three spells of vomiting about a week apart. About three days after the last spell he had the paper on that room sized and varnished. About six weeks has passed since that was done, and he has had no trouble since. The paper had been purchased in this city. The unpleasant symptoms referred to above,

could not, by Mr. Pierce, be attributed to any other cause; and the fact of their disappearance and recurrence being so repeatedly coincident with his exposure in the room, would certainly favor his belief. He thinks he would have suffered serious illness if he had not acted upon the warning which he received through the action of this Board; and the quantity of arsenic and the method of fixing the pigment upon the sample of paper which he presented to the Board was such as to lead to the acceptance of his opinion.

Throughout nearly the entire year for which this report is made, efforts were in progress from time to time by the committee on Special Sources of Danger to Health and Life, etc., of which Prof. Kedzie is chairman, to perfect and publish a series of Rules for the Treatment of the Drowned. They appear in this Report in the article on that subject by Prof. Kedzie. Although these rules were not actually published until after the close of the fiscal year, they should really be credited to the work for that year. The rules finally adopted and published differ slightly from any heretofore published, being more nearly like some recently published by Dr. J. H. Beech, of Coldwater, in this State, than any others which have come to the knowledge of the writer. They seem to meet the approval of those best qualified to judge in the matter, and it is hoped their publication and thorough distribution will result in saving valuable lives which might otherwise be lost. There is believed to be good reason for this hope. During the years 1869, 1870, 1871, and 1872, 380 persons are officially reported as having lost their lives in this State by drowning. It is probable that there were many more not officially returned. The evidence which leads to the belief that many of these lives might have been saved through the vigorous use of the proper means for resuscitation, is strengthened by the fact that it not very infrequently happens that persons supposed to be dead from drowning are accidentally restored to life. The following are instances: A clergyman in this city tells me that such a case is within his knowledge, being that of a young man removed from the water apparently drowned, but who recovered after having been somewhat shaken up by being rapidly conveyed some little distance in a wheeled vehicle of some kind. An editor in this city mentions a similar instance which occurred in the western part of this State a few years since. Two boys were bathing in the edge of a lake, when through some means the oldest sank beyond the reach of the other, and was apparently drowned. The remaining boy ran to the house, a distance of about twenty rods, secured the assistance of his sister, and returned to the lake. The body of the boy was then recovered, and being unable to carry it home, they placed it in a "pounding-barrel" and proceeded to roll the barrel homeward. It will be seen by the above account that the body must have been in the water some little time. Before they reached home the boy that was apparently dead when they started had so far recovered as to vomit, and he was eventually completely restored to life. From a letter received from Dr. J. H. Beech, of Coldwater, I extract the details of another case, as follows: "I have learned from an intelligent young man who was at the 'Silver Lake, Hillsdale county, disaster,' that a young lady who was given up by all present as past hope, was put in a lumber wagon and covered with blankets, for decency's sake only, and the smart jolting effected resuscitation in a drive of a mile or two. She still lives, and it is possible that if some of those left near the lake until the next day, or whose bodies were carried thence with all the tenderness that refinement dictates, had been subject to the energetic shaking of lumber wagons, better results might have surprised the horror-stricken friends."

If resuscitation sometimes occurs, as it is here proved to occur, under such rude and imperfect means as those above-mentioned, without any intelligent effort on the part of friends or by-standers, there seems good reason to hope for a much greater proportion of lives to be saved through the intelligent, energetic and persevering employment of such means as those described in the "Rules for the Treatment of the Drowned," published and distributed by this Board.

The distribution of these printed rules has thus far been as follows: To each of the two thousand seven hundred and five physicians in Michigan whose names and addresses are in the possession of the secretary of this Board; to the editors of each and every newspaper in Michigan; to the editors of all medical and sanitary journals that send their journal to the library of this Board in exchange for its publications; to each of the United States Collectors of Customs in Michigan, who have kindly offered to aid this life-saving work by having them distributed to masters of vessels sailing the great lakes which surround this State; to the supervising inspectors of steam vessels at Detroit, who have also offered to aid in this matter; to the United States Marine Hospital at Detroit; and to various persons supposed to be interested in the preservation of human life by such means.

Besides those first printed and issued by the board, very many thousands have been reprinted therefrom by newspapers and journals; and, to such as have applied therefor, the cuts illustrating the subject have been lent, and by that means the number of complete illustrated copies of these rules has been and will probably hereafter be greatly multiplied, one of the journals, to which the cuts were lent, issuing an edition of nearly twenty thousand copies. There are still many classes of people among whom it is hoped yet to disseminate this information, as, for instance, the police in the different cities, and the 500,000 school population of this State.

During the fiscal year just passed, no Special Report was required of local boards of health, except of the prevalence of any disease which should appear as an epidemic. Judging from the very few reports of such occurrences, one would infer that, during the year for which this report is made, almost every locality in the State was remarkably free from any disease which affected the people generally.

Near the close of the year a circular was issued to the clerk of each local board of health in this State, calling for an Annual Report, similar in character to the one asked for the previous year. Blank forms and instructions were also sent to them at the same time. The circular and blank forms were as follows:

OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH, }  
Lansing, Michigan, September, 1874. }

*To the Clerk of the Local Board of Health:*

SIR—Herewith I send you a blank form [B.] upon which to make your Annual Report to this Board for the year ending September 30th, 1874, as required by law. PLEASE FILL OUT AND RETURN THIS REPORT AS SOON AS POSSIBLE. The blank is similar to one used one year ago. In some cases quite specific replies were then received to the questions relative to permanent conditions, such as soil, streams, timber, etc. Such clerks as are certain that they then gave accurate and full replies to those questions may refer to their former report in answer to such questions in this blank; but many of the questions have reference to facts connected with the deaths, diseases, and conditions during the year ending September 30th, 1874, and require answers without any reference to the previous year. Answers to questions relative to drainage may also be different from those in last report, and should therefore be given explicitly in all cases.

One year ago a form for a "Record of cases of diseases which endanger the public health" was sent to your predecessor, with the recommendation that it be used for recording cases of such diseases occurring within the jurisdiction of your Board of Health. It

was then stated that "by using this, or some similar form of record, you will be better able to meet the requirements of this Board in making your annual and special reports required by law,\* which in future should include a full and exact copy of such record." A circular was issued to the physicians of Michigan, calling attention to the law on this subject, and requesting them to use a form of notice which should furnish facts for such a record in the offices of Clerks of local Boards of Health. The law also requires that a notice be given to the Board of Health, or to the Health Officer by every householder, whenever he shall know that any person within his family is taken sick with the small-pox, or any other disease dangerous to the public health. It is not expected that it will always be possible, from the notices which you receive, to fill every column of your record; but so much as it is possible to learn concerning each case should be recorded and reported, because the single fact of the number of cases of sickness from each such disease will be of value in connection with the records of deaths and other knowledge collected at this office.

I send you a blank sheet of Report of Cases of Diseases Dangerous to the Public Health. If you have any cases on your Record, PLEASE FILL OUT AND RETURN THIS REPORT AS SOON AS POSSIBLE. If you have no cases to report please send a definite statement to that effect, and whether you have cases recorded or not, please state your belief as to whether any cases of such diseases have occurred within your jurisdiction that have not been reported to you, and if so, the probable number of cases of each of such diseases.

The blank which I send for your Report of cases of diseases is essentially the same form as the one recommended by this Board as a proper form for your Record of such cases. If you have not already begun a Record, and desire to do so, you can obtain sheets, or books of sheets similar to this one, except that they are for a Record instead of a Report, at the place and for the price specified in note† on page 18 of the First Report of the Secretary of this Board, a copy of which Report is or should be in your possession.

It is again recommended that your Board of Health have a sufficient number of blank notices printed for the use of householders and physicians within your jurisdiction, and distribute them in order to call attention to the law, and secure the material for a complete record in your office.

In case any disease should appear in your locality as an epidemic, please make a Special Report of the fact to this office as soon as possible, in order that the conditions of its progress and decline may be thoroughly studied.

By direction of the State Board of Health.

Very respectfully,

HENRY B. BAKER, M. D. *Secretary.*

\* Act No. 81, Laws of 1873, Sec. 8. It shall be the duty of the health physician, and also of the clerk of the local board of health in each township, city, and village in this State, at least once in each year, to report to the State Board of Health their proceedings, and such other facts required, on blanks and in accordance with instructions received from said State Board. They shall also make special reports whenever required to do so by the State Board of Health.

† The note referred to was as follows: Sheets of such blank Record can be purchased in this city. The sheets are printed and ruled on both sides, and are the same size and of the same general style as the Assessment Blanks. A small number can be sent by mail on receipt of price and postage, or any number by express on receipt of price, which is 80 cents per quire, or \$3.00 per hundred. Address W. S. George & Co. Lansing, Mich.

[B.]

[Before filling any blanks, please read carefully through the entire form, including foot-notes and instructions.]

ANNUAL REPORT TO THE STATE BOARD OF HEALTH, by the Clerk of the Board of Health for the \*— of —, county of —, State of Michigan, for the year ending September 30th, 187—.

To the Secretary of the State Board of Health:

SIR—The nature of the soil in this \*— is as follows: —.

I estimate the number of acres of low or wet land in this \*— as follows: Swamps, — acres; marshes, — acres; other wet land, — acres.

The streams, ponds, and other bodies of water in this \*— are as follows: —.

The water is stagnant at — season— of the year in the following named streams, ponds, etc.: —.

The beds of the following named streams, ponds, etc., are dry at — season— of the year: —.

The natural drainage of the land in this \*— is by means of —; the soil is — favorable for natural drainage. The artificial drainage is as follows: —. On the whole the drainage is † —.

During the past three years, ditches for the drainage of swamps, marshes, or other low or wet lands have been dug in this \*— to the extent of — rods, and the effect on the health of the people has been for each year since, as follows: —.



The drinking water is  $\frac{1}{2}$  ———. Its quality is  $\frac{1}{2}$  ———. Its source is from § ———. The depth of the deepest well is about ——— feet; the depth of those having the least depth is ——— feet; the depth of the greatest number of wells is ——— feet.

The proportion of the dwellings which have cellars under them is ———. The cellars are ——— wet ——— at ——— season ——— of the year.

In this \* ——— the proportion of the land covered with growing timber is ———.

The kinds of timber which originally grew here, stated in the order of greatest quantity, were ———.

The kinds of timber which now predominate are ———.

The principal crops raised in this \* ——— are ———.

The principal kinds of fruit raised in this \* ——— are ———.

The principal kinds of wild fruit picked in this \* ——— are ———.

I estimate that in this \* ——— the proportion of the dwellings constructed of wood is ———; of brick, stone, etc., ———.

In the greatest number of the dwellings in this \* ——— the average number of rooms is ———; the average size of sleeping rooms is ——— feet by ——— feet; the usual height is ——— feet.

The method of warming the greatest number of the dwellings in winter is by means of ———, and the fuel used is ———.

The greatest number of dwellings are ventilated by means of ———.

Special means of ventilation—other than by open doors and windows—have been adopted as follows: ———.

In the greatest number of cases, the average distance of the privy from the dwelling is ——— feet.

In the greatest number of cases, the average distance of the privy from the well is ——— feet. The least distance in any case is ——— feet. ——— deaths and ——— cases of sickness have occurred, in which there was a probability that the cause was the contamination of drinking water by means of privy drainage.

The number of cases in this \* ——— where dry earth is used (as a deodorizer and purifier) in ordinary privies is ———; in special contrivances is ———.

In ——— case— the privy or earth closet ——— within, or attached to the dwelling.

The principal employments of citizens of this \* ——— (named in order of greatest number employed) is as follows: ———.

——— deaths and ——— cases of sickness have occurred within the year, directly or indirectly, traceable to occupation as a cause. The cases were as follows: ———.

In the greatest number of cases artificial light is obtained by means of ———.

The proportion of cases where kerosene oil is used to produce light is about ———. Deaths and injuries have resulted from its use in the cases, and under the circumstances, as follows: ———.

Paris green is ——— employed for destroying potato bugs. ——— deaths, and ——— cases of sickness have occurred during the year 187—, which could be attributed to that poison. The evidence of death or sickness from this cause was ———.

Compared with previous years, the proportion of deaths to inhabitants in this \* ——— during the year ending September 30th, 187—, was ———.

Compared with previous years, the proportion of sickness among the people of this \* ——— during the year 187— was ———.

The greatest number of the deaths were from the diseases or causes (named in the order of greatest number), as follows: ———.

The greatest number of cases of sickness was from diseases as follows: ———.

During the year ending September 30th, 187—, cases have occurred of epidemic, infectious, or contagious diseases, as follows: Of small-pox, ——— cases; of cholera, ——— cases; of scarlet fever, ——— cases; of typhoid fever, ——— cases; of measles, ——— cases; of whooping cough, ——— cases; of ———, ——— cases.

The date of the first case of each disease was as follows: Of small-pox, ———; of cholera, ———; of scarlet fever, ———; of typhoid fever, ———; of measles, ———; of whooping cough, ———.

The date of the last case was as follows: Of small-pox ———, of cholera ———, of scarlet fever ———, of typhoid fever ———, of measles ———, of whooping cough ———.

Cases of epidemic, infectious, or contagious diseases now prevail as follows: Of small-pox, ——— cases; of cholera, ——— cases; of scarlet fever, ——— cases; of typhoid fever, ——— cases; of measles, ——— cases; of whooping cough, ——— cases; of ———, ——— cases.

The number of deaths during the year ending September 30th, from epidemic, infectious, or contagious diseases, is as follows: From small-pox ———, from cholera ———, from scarlet fever ———, from typhoid fever ———, from measles ———, from whooping cough ———.

So far as known, the sources from which the diseases were derived were as follows: †† Of small-pox ———, of cholera ———, of scarlet fever ———, of typhoid fever ———, of measles ———, of whooping cough ———, of ———.

I attribute the            in this\*            during the past year to the following causes or circumstances:           .

In my opinion the principal sources of danger to life or health in this\*            at the present time are as follows:           .

During the year ending September 30th, 187—, the climatic conditions observed by me were as follows:           .

During the year ending September 30th, 187—, the Board of Health for this\*            has met as a board            time—.

The following is a condensed abstract of the proceedings of this board during the year ending September 30th, 187—:           .

I hereby certify that, to the best of my knowledge and belief, the statements in the foregoing report are correct.

Dated           , 187—.

Signed,           

*Clerk of the Board of Health for the\*            of           .*

#### FOOT-NOTES AND OTHER INSTRUCTIONS.

\* Insert the word township, city, or village.

+ Insert the words, "not good," "bad," "very bad," "good," "very good," etc. Clerks of City Boards of Health will please send a statement for their city of the details of sewerage, disposal of sewage, etc.

‡ Insert the word, "hard" or "soft."

§ Insert the word "wells," "cisterns," or state the facts if otherwise.

¶ After each disease insert the words, "the disease was contracted in the city of           " "or at the school in           " "in a room occupied by persons sick with the same disease            time since," "by means of clothing worn by patient with same disease," etc., etc., as the facts may be. In the case of typhoid fever, if the privy was near the well, or within the dwelling, state the facts.

†† Insert the words "excessive mortality," "excessive sickness," "general healthfulness," or otherwise express the facts.

In filling blanks followed by such words as "deaths," "cases," "feet," "rods," "acres," etc., numbers should be stated if possible, either in words or figures, and "0" should be written where that expresses the truth, for the reason that a blank space indicates that the item has been overlooked.

Please answer the questions as they are printed, and in the blanks left for the purpose. *Do not change or mark out any of the printed matter.* If you wish to communicate any item which will not go in the blank as printed, please write on a separate sheet of paper.

PLEASE FILL ALL BLANKS IN SOME WAY, TO SHOW THAT NONE HAVE BEEN OVERLOOKED.

The blank for a report of cases of diseases dangerous to the public health, referred to in the circular preceding, is given, in a reduced form, on the page following this. It is essentially the same form as has been recommended by this Board as a proper one for a record of such cases. It is very desirable that such a record be kept. Blanks for this purpose can be obtained at the price mentioned in the note at the bottom of the circular, on page xix of this Report.

To the Secretary of the State Board of Health:

Sir:—The following is a Report consisting of a copy of the Record of Cases of Diseases Dangerous to the Public Health which have occurred

RECORD NUMBER.	RECEIVED FOR RECORD.		FULL NAME OF PATIENT.	SEX.	Age last Birthday.	NAME OF DISEASE.
	Month.	Day. Year.				
1.....						
2.....						

In the ..... of ..... County of ..... State of Michigan.

TAKEN SICK.		WHETHER DIED, LIVING, OR RECOV- ERED.	DATE OF DEATH OR RECOVERY.			PERSONS WHO FURNISHED THE FACTS FOR RECORD.	
			Month.	Day.	Year.		
Month.	Day.	Year.				NAME.	P. O. Address.

The reported source of Contagion or Infection, in each case, was as follows: For the case recorded as No. ... it was.....  
I hereby certify that the above Report of cases of Diseases Dangerous to the Public Health is a correct transcript from the Records of this office.  
Dated at ..... 187..

[Official signature.] .....

In tabulating material from returns, it is customary to note exceptions to the general statements, but in this matter of returns from the clerks of local boards of health, the exceptions are more numerous than the intelligent answers. This being the case, it is easier to name the cities, villages, and townships included in Table I., and entitled to credit for compliance with the law, so far as sending a report is concerned, than to note the numerous exceptions. The townships, cities, and villages from the clerks of which reports have been received are as follows: Townships stated in Roman, cities in SMALL CAPS, villages in *italics*.

ALCONA COUNTY.—Alcona, Greenbush,\* and Harrisville.

ALLEGAN COUNTY.—Allegan, Cheshire, Clyde,\* Dorr, Ganges,\* Gun Plain, Lee, Manlius,\* Monterey, Otsego, Pine Plains, and Watson.

ALPENA COUNTY.—Alpena.\*

ANTRIM COUNTY.—Forest Home, Helena, Otsego Lake, and Torch Lake.\*

BARRY COUNTY.—Barry, Carlton, Castleton, Irving, Maple Grove, Woodland,\* and Nashville.

BAY COUNTY.—Clayton, Pinconning, Standish,\* and BAY CITY.

BENZIE COUNTY.—Benzonia, Gilmore, Homestead,\* Inland, Joyfield,\* and Weldon.

BERRIEN COUNTY.—Bainbridge, Hagar,\* Oronoko,\* and Royalton.

BRANCH COUNTY.—Bethel,\* Bronson,\* *Bronson*, and Ovid.

CALHOUN COUNTY.—Albion,\* Battle Creek, BATTLE CREEK,\* Bedford, Convis, Eckford,\* MARSHALL, and Pennfield.

CASS COUNTY.—Calvin, Howard, Ontwa, and Volinia.

CHARLEVOIX COUNTY.—Boyne Valley, South Arm, and Wilson.

CHEBOYGAN COUNTY.—Beaugrand,\* and Grant.\*

CLARE COUNTY.—Greenwood.

CLINTON COUNTY.—Eagle, Greenbush,\* Olive,\* and Westphalia.\*

DELTA COUNTY.—Sack Bay.\*

EATON COUNTY.—Carmel, Delta, Eaton,\* and Windsor.

GENESEE COUNTY.—Argentine, Atlas,\* Burton, Davison,\* Flint, Forest, Mt. Morris,\* Mundy, and Thetford.

GRATIOT COUNTY.—Arcada, *Ithaca*, North Shade,\* and Seville.

HILLSDALE COUNTY.—Adams, Fayette,\* *Litchfield*,\* Reading, and Somerset.\*

HOUGHTON COUNTY.—Adams, Arvon,\* Baraga,\* Hancock,\* *Hancock*,\* L'Anse, and Webster.

HURON COUNTY.—Bloomfield, Dwight, Gore, Meade,\* Paris,\* Port Austin, Rubicon,\* Sebawaing,\* Sherman, Sigel, and Verona.\*

INGHAM COUNTY.—Aurelius, LANSING, and Williamstown.\*

IONIA COUNTY.—Berlin, Danby, Ionia,\* Orleans,\* and Sebewa.

IOSCO COUNTY.—Edwards\* and Grant.

ISABELLA COUNTY.—Chippewa,\* Coe, Coldwater,\* Fremont, Gilmore,\* Roland,\* Sherman, and Vernon.

JACKSON COUNTY.—Concord,\* Henrietta, Rives, and Tompkins.

KALAMAZOO COUNTY.—Comstock,\* Richland, Schoolcraft,\* Texas, and Vicksburg.

KALKASKA COUNTY.—Boardman, Clear Water,\* Cold Springs, Kalkaska, Rapid River, and Wilson.

KENT COUNTY.—Ada, Alpine, Byron,\* Cascade, Courtland, Gaines,\* Grand Rapids, GRAND RAPIDS,\* Paris,\* Sparta, and Vergennes.

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\* Number of cases of diseases prevailing, not stated.

**LAKE COUNTY.**—Cherry Valley, Elk, Ellsworth,\* Killbuck,\* Lake, Pinora,\* Pleasant Plains, and Webber.\*

**LAPEER COUNTY.**—Attica, Burnside, Hadley, Lapeer, LAPEER, and Metamora.

**LEELANAW COUNTY.**—Bingham, Elmwood, Empire,\* Glen Arbor,\* Kasson,\* Leelanaw, and Solon.

**LENAWEE COUNTY.**—Adrian, Blissfield,\* Hudson,\* Macon, Madison, and Palmyra.\*

**LIVINGSTON COUNTY.**—Iosco and Unadilla.

**MACKINAC COUNTY.**—Moran.

**MACOMB COUNTY.**—Chesterfield \* and Ray.\*

**MANISTEE COUNTY.**—Bear Lake,\* Brown, Manistee,\* and Springdale.

**MANITOU COUNTY.**—Galilee.

**MARQUETTE COUNTY.**—Chocolay,\* Ely,\* Forsyth,\* and NEGAUNEE.

**MASON COUNTY.**—Grant, Pere Marquette, Sherman,\* and Summit.

**MECOSTA COUNTY.**—Big Rapids, Colfax,\* Fork,\* Grant, Green,\* Hinton,\* and Millbrook.\*

**MENOMINEE COUNTY.**—Menominee.

**MIDLAND COUNTY.**—Edenville, Grant, Geneva, Huggins,\* Ingersoll, Jasper, Jerome, Lincoln,\* Porter,\* and Warren.\*

**MISSAUKEE COUNTY.**—Clam Union,\* Pioneer, Reeder, Riverside,\* and West Branch.\*

**MONROE COUNTY.**—Ash,\* Exeter, Milan, Summerfield, and Whiteford.\*

**MONTCALM COUNTY.**—Belvedere, Cato, Ferris, Sidney, and Winfield.\*

**MUSKEGON COUNTY.**—Dalton,\* Fruitport,\* Muskegon, Norton,\* Ravenna.

**NEWAYGO COUNTY.**—Ashland, Beaver, Big Prairie,\* Croton,\* Dayton,\* Monroe, and Norwich.\*

**OAKLAND COUNTY.**—Farmington,\* *Farmington*, Groveland, Highland, Holly, PONTIAC, Southfield,\* Springfield,\* Troy,\* and White Lake.\*

**OCEANA COUNTY.**—Benona,\* Colfax, Terry, Golden, Grant, Hart, Leavitt, Otto, and Pentwater.

**ONTONAGON COUNTY.**—Greenland and Rockland.\*

**OSCEOLA COUNTY.**—Highland, Le Roy,\* Orient, and Sherman.

**OTTAWA COUNTY.**—Allendale, Blendon,\* Crockery, Georgetown,\* GRAND HAVEN,\* Holland,\* Jamestown, Robinson.\*

**PRESQUE ISLE COUNTY.**—Presque Isle,\* Rogers,\* and *Rogers City*.\*

**SAGINAW COUNTY.**—Brant, Bridgeport,\* Carrollton, Chesaning,\* Frankenth,\* Saginaw,\* and Zilwaukee.\*

**SANILAC COUNTY.**—Austin,\* Elmer,\* Greenleaf, Maple Valley,\* Marion, Speaker,\* and Worth.\*

**SHIAWASSE COUNTY.**—Caledonia,\* CORUNNA, Middlebury,\* New Haven,\* Rush, and Venice.\*

**ST. CLAIR COUNTY.**—Brockway, Burchville, Casco, China, Emmet, Greenwood, Mussey,\* and Wales.\*

**ST. JOSEPH COUNTY.**—Burr Oak,\* Fabius, Florence,\* Mottville, Park, and Sherman.

**TUSCOLA COUNTY.**—Akron, Almer, Columbia, Elkland, Ellington, Fair Grove, Geneva,\* Indian Fields,\* Novesta,\* Wells, and Wisner.\*

**VAN BUREN COUNTY.**—Bloomingdale, Decatur, Keeler, and Paw Paw.

**WASHTENAW COUNTY.**—Angusta\* and Lyndon.\*

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\* Number of Cases of Diseases prevailing, not stated.

WAYNE COUNTY.—DETROIT,\* Greenfield, Grosse Point,\* Huron, *Plymouth*,\* Redford,\* Sumpter,\* and Taylor.\*

WEXFORD COUNTY.—Antioch, Cedar Creek, Cherry Grove, Colfax, Hanover, Henderson,\* Selma and Springville.

The number of local Boards of Health in the State, and the number of clerks that sent in a report may be seen in Table I. It will be seen that of 38 Boards of Health for cities, reports were received from 11. Of 152 for villages, reports were received from only 9. Of 957 Boards of Health for townships, reports were received from 325. Of the 1,147 local Boards of Health in the State, only 345 clerks have complied with the law requiring them to send a report to this State Board of Health. The fact that 345 clerks sent in reports is some evidence that there was no real impossibility in the matter, and that the others might have done so if they chose. That justice may be done those clerks that have faithfully performed this duty, the townships, cities, and villages from which reports have been received, are specified by name in the foregoing statement by counties. If the clerks of Boards of Health not mentioned in that statement wish to shift the responsibility, for non-compliance with the laws, from themselves, where it now seems to rest, to the physicians and householders who do not report to them, they have only to make their reports promptly to this office, stating the facts asked for, including statements of reports to them by physicians and householders, or the absence of such reports, and the action or non-action of their own local Board of Health. The law requiring reports from each clerk does not exempt one of them from that duty when the Board of which he is clerk does not meet or perform any of its duties, nor even when physicians and householders make no reports to him. As a resident of the locality, the clerk is supposed to have some knowledge of the local conditions, obtained by previous intelligent observation, or at least to be able to gain such knowledge from the local records or from actual inspection. He is asked for a statement, according to the best of his knowledge and belief, as to certain points in the topography of the township, city, or village, of which he is clerk, relative to certain sanitary conditions therein, and as to the sickness and deaths from diseases which endanger the public health and which are believed to be in great part preventable. There is believed to be required nothing impossible or even extremely difficult. But the information sought to be obtained is of such importance that even though it should be extremely difficult to obtain it, there is good reason why it should be demanded until obtained. There is, undoubtedly, a "law of supply and demand." Knowledge respecting any subject is not likely to be collected except through some effort. This knowledge, which to the public is the most important of all knowledge, because it is needed to enable the people to act out the "first great law of nature, self-preservation," is no exception to the rule. It would never be systematically collected, and our present ignorance would continue to be profound, except for some methodical plans and demands for its production. It is believed to be the duty of this Board to make and to continue this demand in the interests of the people until the supply shall be generous and prompt.

One would think that all classes of people should be easily interested in the subject of public health, and that they would soon see to it that they elect those to office as guardians of the public health and life who will attend to the duties of the office, for it should be considered that although the items of information which may be collected and contributed by any one officer, as for in-

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\* Number of Cases of Diseases prevailing, not stated.

stance the clerk of a Board of Health, may appear to be of very little importance by itself, still these in the aggregate give us all the official information we have concerning many very important subjects bearing upon questions affecting the lives of vast numbers of our citizens.

Comparing the number of clerks that have reported with the whole number which should have reported, the result is somewhat discouraging; but really this is not the best method of comparison, for it could hardly have been expected that a law so new to many of those who are expected to act under it would be immediately and completely executed. The outlook is much more encouraging when we consider that heretofore there has been not the slightest movement towards a collection of any such knowledge, and that, instead of that absolute inactivity and entire ignorance, we now have reports from the clerks of three hundred and forty-five local boards of health, including many statements of important facts, which will undoubtedly prove useful hereafter.

TABLE I.—*Exhibiting, for the State and by Counties, the Number of Local Boards of Health for Cities, Incorporated Villages, and Townships in Michigan; for each of these Classes of Boards of Health, the Number from which an Annual Report was Received for the year ending September 30, 1874; the Number of Clerks that Reported relative to Cases of Diseases Prevailing at the time the Report was made, and the Number of Cases thus reported of Certain Diseases which Endanger the Public Health.*

STATE AND COUNTIES.	CITIES.		INCORPORATED VILLAGES.		TOWNSHIPS.		Total Number of Clerks of Boards of Health that have reported in compliance with the law.	CASES OF DISEASES PREVAILING AT TIME OF REPORT.*						
	Total Number of.	Number of Clerks that have reported.	Total Number of.	Number of Clerks that have reported.	Total Number of.	Number of Clerks that have reported.		Clerks that have reported on this subject.	Small-pox.	Cholera.	Scarlet Fever.	Measles.	Whooping Cough.	Typhoid Fever.
State.....	38	11	152	9	957	325	345	204	—	—	23	27	131	60
Alcona.....	—	—	—	—	3	3	3	2	—	—	—	—	—	—
Allegan.....	—	—	6	—	24	12	12	9	—	—	—	—	—	4
Alpena.....	1	—	—	—	4	1	1	—	—	—	—	—	—	—
Antrim.....	—	—	—	—	10	4	4	3	—	—	—	—	—	—
Barry.....	1	—	2	1	16	6	7	6	—	—	—	—	4	—
Bay.....	1	1	2	—	14	3	4	3	—	—	—	—	—	6
Benzie.....	—	—	1	—	11	6	6	4	—	—	—	—	—	—
Berrien.....	1	—	6	—	20	4	4	2	—	—	—	—	—	—
Branch.....	1	—	3	1	16	3	4	2	—	—	—	—	—	—
Calhoun.....	2	2	3	—	20	6	8	5	—	—	—	—	—	3
Cass.....	—	—	2	—	15	4	4	4	—	—	—	—	15	2
Charlevoix.....	—	—	—	—	8	3	3	3	—	—	—	—	—	—
Cheboygan.....	—	—	1	—	6	2	2	—	—	—	—	—	—	—
Chippewa.....	—	—	1	—	3	—	—	—	—	—	—	—	—	—
Clare.....	—	—	—	—	6	1	1	1	—	—	—	1	—	—
Clinton.....	—	—	2	—	16	4	4	1	—	—	—	—	—	1
Delta.....	—	—	1	—	8	1	1	—	—	—	—	—	—	—
Eaton.....	1	—	5	—	16	4	4	3	—	—	—	—	—	1
Emmet.....	—	—	—	—	3	—	—	—	—	—	—	—	—	—
Genesee.....	1	—	4	—	18	9	9	6	—	—	—	—	1	3
Grand Traverse.....	—	—	—	—	10	—	—	—	—	—	—	—	—	—
Gratiot.....	—	—	3	1	16	3	4	3	—	—	—	7	—	—
Hillsdale.....	1	—	3	1	18	4	5	2	—	—	—	—	—	—

\* For townships, cities, and villages represented, see preceding statement by counties.

TABLE I.—CONTINUED.

COUNTIES.	CITIES.		INCORPORATED VILLAGES.		TOWNSHIPS.		Total Number of Clerks of Boards of Health that have reported in compliance with the law.	CASES OF DISEASES PREVAILING AT TIME OF REPORT.						
	Total Number of.	Number of Clerks that have reported.	Total Number of.	Number of Clerks that have reported.	Total Number of.	Number of Clerks that have reported.		Clerks that have reported on this subject.	Small-pox.	Cholera.	Scarlet Fever.	Measles.	Whooping Cough.	Typhoid Fever.
Houghton.....	—	—	4	1	13	6	7	3	—	—	—	—	2	—
Huron.....	—	—	—	—	23	11	11	6	—	—	—	—	20	—
Ingham.....	1	1	5	—	16	2	3	2	—	—	—	—	many	7
Ionia.....	1	—	6	—	16	5	5	3	—	—	—	—	20	—
Iosco.....	—	—	1	—	10	2	2	1	—	—	—	—	—	—
Isabella.....	—	—	—	—	14	8	8	4	—	—	—	several	—	4
Jackson.....	1	—	3	—	19	4	4	3	—	—	—	—	—	—
Kalamazoo.....	—	—	6	1	16	4	5	3	—	—	—	—	—	—
Kalkaska.....	—	—	—	—	8	6	6	5	—	—	—	—	—	—
Kent.....	1	1	5	—	24	10	11	7	—	—	—	2	—	3
Keweenaw.....	—	—	—	—	8	—	—	—	—	—	—	—	—	—
Lake.....	—	—	—	—	10	8	8	4	—	—	—	—	—	—
Lapeer.....	1	1	2	—	18	5	6	7	—	—	—	5	—	1
Leelanaw.....	—	—	1	—	10	7	7	4	—	—	—	—	9	—
Lenawee.....	1	—	7	—	22	6	6	4	—	—	—	—	great many	few.
Livingston.....	—	—	3	—	16	2	2	2	—	—	—	—	—	—
Mackinac.....	—	—	1	—	3	1	1	1	—	—	—	—	—	—
Macomb.....	—	—	6	—	14	2	2	2	—	—	—	—	—	—
Manistee.....	1	—	1	—	10	4	4	2	—	—	—	—	—	—
Manitou.....	—	—	—	—	4	1	1	1	—	—	—	—	—	—
Marquette.....	3	1	—	—	8	3	4	1	—	—	—	—	1	—
Mason.....	1	—	—	—	11	4	4	3	—	—	—	—	—	—
Mecosta.....	1	—	1	—	14	7	7	2	—	—	—	—	—	—
Menominee.....	—	—	1	—	3	1	1	1	—	—	—	—	—	6
Midland.....	—	—	1	—	16	10	10	6	—	—	—	—	—	2
Missaukee.....	—	—	—	—	6	5	5	2	—	—	—	—	—	—
Monroe.....	1	—	2	—	15	5	5	3	—	—	—	—	4	7
Montcalm.....	1	—	3	—	20	5	5	4	—	—	—	—	—	2
Muskegon.....	1	—	2	—	16	5	5	2	—	—	—	—	—	—
Newaygo.....	—	—	2	—	16	7	7	3	—	—	—	—	—	—
Oakland.....	1	1	8	1	25	8	10	5	—	—	2	10	some	2
Oceana.....	—	—	1	—	16	9	9	8	—	—	—	—	14	1
Ontonagon.....	—	—	—	—	5	2	2	1	—	—	—	—	—	—
Osceola.....	—	—	2	—	15	4	4	3	—	—	—	—	—	—
Ottawa.....	2	1	2	—	15	7	8	3	—	—	—	—	—	1
Presque Isle.....	—	—	1	1	2	2	3	—	—	—	—	—	—	—
Saginaw.....	2	—	4	—	24	7	7	2	—	—	—	—	—	—
Sanilac.....	—	—	1	—	24	7	7	2	—	—	—	—	—	—
Schoolcraft.....	—	—	—	—	3	—	—	—	—	—	—	—	—	—
Shiawassee.....	2	1	2	—	16	5	6	2	—	—	1	—	—	—
St. Clair.....	2	—	3	—	23	8	8	6	—	—	20	—	—	4
St. Joseph.....	—	—	5	—	16	6	6	4	—	—	—	2	17	—
Tuscola.....	—	—	2	—	24	11	11	7	—	—	—	—	6	—
Van Buren.....	—	—	5	—	18	4	4	4	—	—	—	—	—	—
Washtenaw.....	2	—	4	—	20	2	2	—	—	—	—	—	—	—
Wayne.....	2	1	4	1	18	6	8	2	—	—	—	—	—	—
Wexford.....	—	—	—	—	13	8	8	7	—	—	—	—	18	—



If any evidence were needed to show the very great necessity of some measures which shall infuse some sort of activity into the guardians of the public health throughout the country, it might be obtained from the facts exhibited in Table I. Out of 38 cities in this State, only eleven have a clerk of a board of health who has sufficient respect for the law of his State or care for the interests of human life entrusted in part to his care, to fill out and send a report of the sanitary condition of his city. From the fact that some of those clerks who send in reports state that they have no well organized local board of health, it is probable that in some cases where no reports are sent in, the charter of the city provides for a board of health in some other manner than by the service of the entire common council of the city, and through this theoretical board of health which has no real active existence, the city clerk feels relieved from duty as clerk of a local board of health, required by law to report to this Board. As the general law actually reads, the council of a city or the trustees of an incorporated village are required to exercise all the powers and perform all the duties of local boards of health.

Section (1740) 49, of Chapter XLVI., Compiled Laws of 1871, provides that "The mayor and aldermen of each incorporated city, and the president and council, or trustees, of each incorporated village in this State, shall have and exercise all the powers and perform all the duties of a board of health, as provided in this chapter, within the limits of the cities or villages respectively, of which they are such officers."

In this case there is not, as there is in the case of townships, an exception of localities through the clause, "respecting which, no other provision is or shall be made by law."

As regards villages, the case is worse than in cities. Out of 152 incorporated villages, an Annual Report for the year ending September 30, 1874, has been received from only 9 clerks. There seems to be a greater degree of indifference, to all laws and measures for promoting the public health, in villages than in either cities or townships; and this is particularly unfortunate, because it is in just such places that so much can be done in the way of preventing sickness and death. It is in villages that the water supply is peculiarly liable to be contaminated, and the inhabitants to be decimated in consequence, through such diseases as diarrhea, dysentery, and typhoid fever. It is in villages that the ordinary contagious diseases spread with such facility and rapidity, through the free communication of children. It is in villages that that fearful disease—Cerebro-Spinal Meningitis, or Spotted Fever, most frequently causes the greatest destruction of life. If every village had an actual and active Board of Health, how much *might* be done to search out and remove some of these causes of sickness and death which now strike down hundreds from the village population of this State in every year.

It is possible that some part of this apparent indifference really comes from comparative ignorance of the subject, both as regards the possibility of preventing sickness and death through sanitary work, and of the duties of village councils as local boards of health. In fact, it is not reasonable to expect that members of village councils, elected to perform the various duties of the office, should always be fully acquainted with the latest teachings of sanitary science. It is for this reason that this State Board of Health endeavors to collect information relative to the best means of action for the preservation of the public health, and to disseminate such information, more particularly among officers of local boards of health.

A greater proportion of the clerks of townships reported than did the clerks of either cities or villages. Of 957 townships the clerks of 325 sent in an annual report for the year ending September 30, 1874.

Reports from the clerks of local boards of health reveal the fact that many of them have never met as a board of health. There seems to be no law requiring them to meet at any stated time. There are some reasons why it seems desirable to have a slight change in the law, such as would make the board of health in every township, concerning which no other provision is made by law, to consist of precisely the same officers as the township board, and of no others. This would probably facilitate the business of the board, and the auditing of its bills, and generally promote the interests of public health.

The theory upon which local boards of health sometimes appear to act is to do nothing unless there is quite a general clamor among the people because of some intolerable nuisance which is so obvious to all that it is absolutely unbearable. With some of these local boards of health there seems to be no thought of being in advance of the people, and of leading in measures for the preservation and prolongation of human life. Perhaps a part of this inaction results from the general principle that "what is everybody's business is nobody's business," and it is not made the business of any person to call meetings of local boards of health for the purpose of *inaugurating* measures for promoting the public health. If the township board were also the board of health, there would necessarily be at least one meeting in each year; but if the local board of health for townships remains as at present constituted, it should be required by law to meet at stated times. But even without any further legal enactment, if local boards of health will be sufficiently awake to the responsibilities of their position, they can do something toward doing away with the odium which now so generally attaches to them because of their inactivity.

In some instances clerks of local boards of health seem to have had some difficulty in obtaining pay for their services in connection with their reports to this Board. It would seem that they should certainly receive pay for such services, and from the same source and in the same manner as for their other ordinary duties, which are specified in the laws of this State. The law plainly makes it one of their duties to make annual and special reports to this Board.

#### EXPENDITURES.

Although the main functions of this Board are not financial, considerable thought has to be devoted to this subject in order to make the limited amount placed at the disposal of the Board go as far as possible toward carrying into effect some of its numerous plans for promoting the public health, and preventing unnecessary sickness and deaths. Some explanation may be necessary in order to enable the reader to understand the statements following. The appropriations have been construed to be for the calendar year ending December 31; the Annual Reports of this Board, as of other State officers, are for the fiscal year ending September 30, while the Secretary of this Board is required to make a report to the Board at its annual meeting in April. The first annual report of the Secretary relative to the finances of the Board, as appears by the record of proceedings at the annual meeting in April, 1874, was as follows:

*To the President and Members of the State Board of Health:*

GENTLEMEN—In accordance with section 5 Article II., of our by-laws, I submit the following report for the first fractional year ending in April, 1874, relative to property purchased, issued, used, and on hand.

## STATE BOARD OF HEALTH—REPORT OF SECRETARY.

Instruments and articles of similar nature, have been purchased for, or presented to this board as follows:

One set of five thermometers, including a wet-bulb thermometer, for meteorological observations, purchased of J. Green of New York.

One complete "State Board of Health Oil-Tester," and accompanying thermometer, presented by Prof. R. C. Kedzie.

One spring hand stamp, one letter-book dampener, and forty file boxes, purchased.

The instruments and items of property described above are in the possession of the Secretary, and are in good condition.

Books have been purchased for, or presented to the board, as follows:

A "Record of Proceedings" was procured and is in use by the Secretary.

The first book presented to the Library of this Board was a copy of "Leeds on Ventilation," presented by Major J. S. Baker of Lansing. Bound volumes of the "Herald of Health" for the years 1870, 1871, and 1872 have been presented to the board by the editor, M. L. Holbrook, M. D.

A volume of the "Testimony and Arguments before the State Board of Health of Massachusetts, in the case of Tyler *et al.* vs. Squire *et al.*," has been received. The two volumes of Compiled Laws of Michigan, 1871, a complete set of the Registration Reports of this State, and a copy of the Statistics of Michigan for the years 1860, 1864, and 1870 have been received from the office of the Secretary of State, and placed in the library.

Volumes 69 and 70, Laws of Ohio for 1872 and 1873, have been received from the Secretary of State of Ohio. The "Herald of Health" for 1874 is being regularly received, and is a contribution to the library of the board, by Rev. C. H. Brigham of Ann Arbor. In exchange for the publications of this office, the following sanitary and medical journals are regularly received: the "Sanitarian," of New York, the "Lancet and Observer," of Cincinnati, the "Peninsular Journal of Medicine," of Detroit, and the "Detroit Review of Medicine and Surgery." All the books and publications named above are in the library, and are in good condition.

Paper has been purchased for the use of this Board as follows:

3 Reams of Lithographed Letter Heads, \$7 50.....	\$22.50
1 Ream of Foolscap paper.....	3.71
1 Ream of Letter paper.....	3.00
1 Ream of 28 lb. Demy paper.....	8.00
3 Reams of 24 lb. Demy paper.....	17.83
7 Reams of 24 lb. Folio Post paper.....	38.22

Total cost of paper purchased.....\$93.25

Paper has been issued as follows: To each of six members of this Board, 100 sheets double letter lithographed, and 50 sheets single letter lithographed paper. Also to Dr. Kedzie, 6 quires of foolscap paper. There is on hand about 60 sheets of double, and 200 sheets of single letter lithographed, leaving about 700 sheets of lithographed letter paper which has been used in this office.

Of plain letter paper, only about  $\frac{1}{4}$  ream has been used; the remaining  $\frac{3}{4}$  ream is on hand. Of the foolscap paper there is on hand about  $\frac{1}{2}$  ream.

There is on hand about  $\frac{3}{4}$  ream of 28 lb. demy paper, and  $\frac{3}{4}$  ream of 24 lb. folio post paper. Except about  $\frac{1}{4}$  ream of the 28 lb. demy used for "Record of Proceedings," the rest of the hard paper purchased has been used for circulars.

issued by this office or by chairmen of committees: using for this purpose 3 reams of 24 lb. demy, and 6½ reams of 24 lb. folio post paper.

Thirteen thousand five hundred envelopes have been purchased, at a cost of \$40.77.

Sixty envelopes have been issued to each of six members of the Board; and, in addition to this number, 100 to Dr. Kedzie, 800 to Dr. Lyster, and 1,000 to Dr. Hitchcock, in which to send out circulars, making a total of 2,260 envelopes issued. There are on hand about 2,240 envelopes, making 4,500 to be deducted from the 13,500 purchased, and thus leaving 9,000 as the number of envelopes used in the office of the Secretary. About 1,800 of these were used in sending out circular No. 2—to physicians. About 1,200 were used in sending out each one of circulars Nos. 1 and 3, and the circular issued by Dr. Bliss, Chairman of Committee No. 1. This would account for about 5,400 of the envelopes used in this office. The remaining 3,600 are believed to have been used in the ordinary correspondence of the office, and in sending circulars, documents, etc., to editors and persons interested in subjects relating to public health.

I have on hand about 1,500 envelopes, printed in different forms, not purchased by the Board, but printed and sent through mistake, and which have been given to the Board. It is possible that they may be useful hereafter.

Box-rent and postage stamps have been purchased amounting to \$150.28. I have issued to Dr. Lyster, to send out his circular, four hundred one cent stamps, \$4.00. There are on hand vouchers for stamps, etc., amounting to \$62.81. These two items, deducted from the \$150.28 paid for stamps, etc., leaves \$83.47 used at this office. The circulars sent out required, as a rule, one cent each, requiring for circular No. 1, about \$12.00; for circular No. 2, about \$18.00; for circular No. 3, about \$12.00, or about \$42.00 in all. This, subtracted from \$83.47, leaves \$41.47. Two or three dollars of this was used to pay box-rent and postage on mail-matter received. The remainder has been used for the ordinary correspondence of the office, for sending sets of circulars to exchanges, etc., and for postage on registration reports, documents, and copies of the First Annual Report.

Thus far I have reported approximately concerning the most important items of property of the Board, accounting for all the instruments purchased, to the value of \$36.75; for paper and envelopes, amounting to \$134.02; for all postage purchased for use at or issued from the office of the Secretary, amounting to \$150.28; and for file-boxes, costing \$14.00, included in miscellaneous purchases. In order to show precisely how much has been expended for minor items of stationery, and for other purposes than for property, and consequently not mentioned in this Report, the following statement has been prepared, and exhibits the exact amount of all expenditures and purchases up to date so far as bills have been received. This statement includes vouchers Nos. 1 to 53, inclusive, but does not include the expenses of members in attending this meeting [April, 1874], or any voucher after No. 53.



HENRY F.  
VAUGHAN  
LIBRARY

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ENTAILMENTS OF ALCOHOL.

—◆—  
BEING THE ANNUAL ADDRESS

TO THE

STATE BOARD OF HEALTH OF MICHIGAN,

BY

H. O. HITCHCOCK, M. D.,

OF KALAMAZOO, PRESIDENT OF THE BOARD.

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## ENTAILMENTS OF ALCOHOL.

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In the discharge of the annual duty which this Board has devolved upon its President, I have thought that the effort should be not so much to produce an ornamental paper, a sort of "frontispiece" to the annual report, as to produce a paper in the very line of the legitimate *work* of the Board; one that should gather up many facts heretofore known, bearing, in some direction, upon the physical welfare of men, and seek to deduce from them general truths that shall guide to efforts for their well being; in other words, a paper that shall start an amorphous field of fact and truth into a crystallization of law and effort.

In casting about for such a field, the group of facts growing out of the nature of ALCOHOL; its physiological action upon the tissues of the human body; the vast quantities of it which are used under the various forms of alcoholic drinks; the pathological effects of its use upon its consumers; and, above all, its effects upon their posterity, were so great as at once to challenge my attention, and to demand, as it seems to me, the most profound and earnest consideration of this Board.

### WHAT, THEN, IS ALCOHOL, AND WHAT IS ITS NATURE?

In chemical language, it is a hydrated oxide of ethyle. Its composition is  $C_2H_5O + H_2O$ . It is nowhere to be found in any product of nature; was never itself created by God, but is essentially an artificial thing, prepared by man through the destructive process of fermentation.

Alcohol is classed as a narcotic or narcotico-acrid poison by Profs. Orfila, Christison, Beck, Stille, and Drs. Periera and Taylor, and indeed by every writer on toxicology.

It is the same identical thing wherever found; in all intoxicating drinks in this country it is *the thing* which intoxicates, its proportions in them varying from 5 per cent in some forms of ale to 53 per cent in brandy, rum, and whisky.

Alcohol *is not a food*. It forms no part of the fibrine, albumen, and casein out of which all the tissues are organized, nor of the fat, starch, and sugar which are chiefly used to generate heat in the body. Neither does it in any way aid in the digestion of the food; but on the contrary the presence of it in the stomach retards or impedes digestion by precipitating the active agent in that function, viz., the pepsine. These facts have been fully established by many eminent physiologists.

"It is a remarkable fact," says Dr. Dundas Thompson, "that alcohol, when added to the digestive fluid, produces a white precipitate, so that the fluid is no longer capable of digesting animal or vegetable matters."

"The use of alcoholic stimulants," say Drs. Todd and Bowman, "retards



digestion by coagulating the pepsine, an essential element of the gastric juice, and thereby interfering with its action."

The truth of this position has also been demonstrated in the living human stomach by Dr. Beaumont, in the case of Alexis St. Martin.

"The only influence of alcohol in the stomach," says Dr. Henry Munroe of England, "is that of an irritant."

While the alcohol, taken with, just before, or just after the food, remains in the stomach, digestion is wholly arrested and cannot go on until, fortunately very soon, the offending article is taken up into the blood and is on its way, unfortunately through the whole system, to the emunctories, to be cast out *unchanged* as the offending devil alcohol. That the alcohol is cast out of the system unchanged by the emunctories, has been proven by the new test for alcohol proposed by Dr. Rudolph Masing, viz., a solution of the bichromate of potash and sulphuric acid. By this test, too, alcohol has been found unchanged in all the tissues of drunkards' bodies.

#### WHAT ARE ITS PHYSIOLOGICAL ACTIONS UPON THE TISSUES OF THE HUMAN BODY?

Taken undiluted into the stomach it would burn and destroy the tissues with as much certainty and almost as speedily as so much aqua fortis.

It has been demonstrated by many physiological experimenters that alcohol, even when largely diluted, coagulates the soluble albumen of the tissues and corrugates them. It changes their chemical relations and properties, so as greatly to disturb the normal series of changes involved in the nutritive operations. Changes in the physical or chemical nature of the animal tissues involves also disorder in their vital properties. "Now, as it is probable that nearly all the organized tissues are developed at the expense of the fibrine, it is obvious that anything that impairs its organizability must have an injurious influence upon the general nutritive operations, and we shall hereafter find confirmation of this inference in that peculiar condition of the system, which results from excessive habitual indulgence in alcoholic potations, and of which the imperfect elaboration of the fibrine is one of the special characteristics."<sup>1</sup>

Alcoholic liquors, applied to the skin or mucus membrane, produce various degrees of irritation, even to inflammation and death of the part, according to their strength and the length of time they are applied. "Alcohol, when applied to the living tissues," says Carpenter, "in a sufficiently dilute form exalts for a time their vital activity, but this exaltation is temporary only, and is followed by a corresponding depression." It is a stimulant and narcotic.

Alcohol, too, has a remarkable action upon the blood, giving to arterial blood a venous color, causing the red corpuscles to shrink and lose their regular shape and to lose a part of their contents, which must seriously affect their two functions, aeration and nutrition. (*Carpenter.*)

#### HOW MUCH ALCOHOL AND ALCOHOLIC DRINKS ARE USED?

I have availed myself of the following facts as collected from reliable sources by Dr. Chas. A. Story, of Chicago:<sup>2</sup>

"There were manufactured in the United States in the year 1867, 100,000,000 gallons of distilled spirits, or about three gallons to every man, woman, and child in the republic."

<sup>1</sup> Carpenter—Use and Abuse of Alcoholic Liquors.

<sup>2</sup> Alcohol: Its Nature and Effects.

"Of brewed liquors 400,000,000 gallons, or twelve gallons to each man, woman, and child in the republic."

"Of wines 20,000,000 gallons, and imported liquors 20,000,000."

The value of the sales by retail liquor dealers in the United States during the year 1865, according to the report of Commissioner Wells, was \$1,483,491,865, or just about \$48 to every man, woman and child in the land. Of this vast sum the people of this State are said to have spent \$52,874,170, or within a fraction of \$45 for every man, woman and child in the State at the present time.

As now one-fourth of the total population would more than cover all who drink, it follows that, at a very low estimate, there is expended on an average each year, for every person in this State or the United States who drinks, the sum of \$200 in round numbers.

#### THE PATHOLOGICAL EFFECTS OF ITS USE UPON THE CONSUMERS.

Now if alcohol is necessary as an article of food, bad effects ought not to flow from even so free use of it. But those persons who use the most of it ought to thrive the best; ought to live the longest, and to have the best physical, mental, and moral development.

But if alcohol is not necessary for food,—*if it is not food, but is a poison*,—we ought to look for the most baneful effects from so free a use of it.

Now the effect of the habitual use of alcoholic drinks, however diluted, is shown by many eminent physiologists, and by the observation of many eminent physicians, to be similar in nature, though not identical in degree, to the effect of undiluted alcohol upon the tissues.

Although it is almost entirely cast out by the emunctories, the skin, the lungs, the liver and the kidneys, and always *as* alcohol; yet, in passing through all parts of the system, it does, as we shall see, leave everywhere the marks of its burning footsteps. "By experimenting on the blood with sherry wine or diluted alcohol, the blood disc becomes altered in shape and throws out matter from its interior; minute molecular particles also fringe the circumference. Some of these molecules separate from the blood discs and float about in the field; others elongate into tails, which move about with a tremulous motion. When the liquor sanguinis becomes surcharged with alcohol, either by imbibition of small quantities daily or by a large quantity suddenly, the blood corpuscles swimming in it not only become affected, but also the liquor sanguinis itself suffers deterioration."<sup>1</sup>

"The coloring matter," says Prof. Shultz, "is dissolved out of the blood discs, and the pale discs lose all their vitality, whence less oxygen can be absorbed and less carbon carried out."

The experiments of Dr. Bocker, confirmed by Dr. Virchow, prove that "alcohol poisons the blood, arrests the development, as well as hastens the decay of the red corpuscle." "Dr. Bocker noticed the alterations undergone by the blood of habitual alcohol drinkers *as yet in good health*, viz., a partial loss of power to become red by exposure to the air, in consequence of the loss of vitality in a portion of the blood discs. This loss of vitality manifests itself by the formation of black specks (oil) in the discs (an observation confirmed by Lallemand), and then by their conversion into round pale globules, which in all cases of disease, (*i. e.* diminished vitality) are found in excess in the blood."<sup>1</sup>

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<sup>1</sup> The Physiological Action of Alcohol. By Henry Munroe, M. D., F. L. S.

"This devitalized condition of the nutritive fluid," says Dr. Munroe, "is probably the first step to the deterioration of the tissues which it feeds."

"The eminent French analytical chemist, Lecanu, found as much as 117 parts of fat in 1,000 parts of a drunkard's blood, the highest estimate of the quantity of health being 8½ parts, while the ordinary quantity is not more than two or three parts, so that the blood of the drunkard contains *forty times* in excess of the ordinary quantity." (*Henry Munroe.*)

This is fatty degeneration of the blood, and lays the foundation of fatty degeneration of all the tissues of every organ of the body, which is the basis, according to Dr. T. K. Chambers, of "three-quarters of the chronic illnesses which the medical man has to treat."

Can a blood thus vitiated, and bearing in its tide the very polluting and destroying substance itself, minister to and build up healthy organs? Must not all their functions become deranged, and thus a legion of diseases be caused?

"When spirituous liquors are taken into the stomach," says Dr. Aitken in his "Practice of Medicine," "they tend to coagulate in the first place all albuminous articles of food or fluid with which they come in contact. *As an irritant* they stimulate the glandular secretions from the mucous membrane and ultimately lead to *permanent congestion of the vessels* and to *thickening of the gastric tissues.*"

"Even diluted in the form of beer or wine," says Dr. Lankester, F. R. S., in his School Manual of Health, "it is found to act injuriously on the delicate membranes of the stomach and other digestive organs. When taken in larger quantities in any of the diluted forms, it acts most injuriously upon the stomach, liver, brain, heart, and other organs of the body."

The organs most affected by alcohol when taken into the stomach—the organs in which it is found most to accumulate—are, according to the eminent physiologists, Professors Lallemand and Perrin, the "liver and the substance of the brain. If in the blood it is represented by 1., in the brain it is 1.34, in the liver 1.48."

Let me call your attention to *a list of diseases and degeneracies which are developed in and bequeathed to the individuals themselves who habitually or excessively use alcoholic drinks.*

For convenience I shall mainly follow Carpenter's list, sometimes using his identical language. This list has been justified and confirmed by thousands of observers, among whom are many physicians in this and other States who have replied to a circular which I sent out upon this subject, and to which reference will be made hereafter.

That intemperance is one of the conditions which tends to produce inflammations of the encephalon, meningitis, and cerebritis, all writers upon the subject agree. A frequent connection, as cause and effect, is established both by theory and observation with habitual intemperance and cases of apoplexy, paralysis, and epilepsy.

Besides these positive diseases, a premature exhaustion of nervous power, manifested in the decline of mental vigor and of nervo-muscular energy, are ranked by common consent among the consequences of habitual excess in the use of alcoholic liquors. That irritation and inflammation of the mucous membrane of the stomach, with a thickened, softened and ulcerous condition, is thus caused, is not only attested by hundreds of medical observers, but in the

case of Alexis St. Martin was clearly demonstrated in the living stomach by Dr. Beaumont.

He says: "The free use of ardent spirits, wine, beer, or any intoxicating liquor, when continued for some days, has invariably produced these morbid changes."

Inflammatory gastric dyspepsia, with all its attendant cutaneous eruptions and persistent derangements of the liver and kidneys, and its consequent depression of spirits even to complete hypochondriasis, is often the legitimate result of the habitual use of intoxicants.

Dr. Peters, as quoted by Dr. Carpenter, has pointed out the effects upon the livers of seventy persons dead after the habitual use of alcoholic drinks. "In moderate drinkers the liver was generally found to be somewhat larger than usual, its texture softened, and its outer surface spotted with patches of fatty infiltration extending two or three lines into the parenchymatous substance, the rest of the viscus retaining its natural color and its edges their normal sharpness. In those who had been more addicted to the use of spirits, the liver was still larger, its edges were more obtuse, and the patches of fat on its surface were larger and more numerous. In old drunkards the liver was very large, weighing at least six or eight pounds, often from ten to twelve; the edges were very thick and much rounded, the parenchyma almost white with fat, soft, fragile, and the peritoneal covering could be torn off with ease.

"These observations indicated the various degrees of fatty degeneration, the result on the one hand of deficient functional activity of the gland, and on the other, indicative of an excess of fatty matter in the system." To these conditions are to be added the granular liver, or the "gin liver," as it is called.

Quite analogous to these degenerated conditions of the liver are the various degenerations of the kidneys, especially Bright's disease, or granular degeneration of the kidneys.

Of this disease Dr. Christison states that "from three-fourths to four-fifths of the cases which he met with in Edinburgh were in persons who were habitual drunkards, or were in the constant habit of using ardent spirits several times in the course of the day."

"The experience of English hospitals is precisely similar," says Dr. Carpenter.

Gout and rheumatism are often found to be directly or indirectly caused by the use of alcoholics. Acute and chronic inflammation of the heart and arteries are not infrequently traceable to alcoholic intoxication, and "it cannot therefore be regarded as impossible," says Dr. Carpenter, "that those more chronic disorders of their walls, which give rise to aneurism, softening, fatty degeneration, and other structural changes should be favored if not absolutely produced by the habitual presence of alcohol in the circulating current."

Besides these positive diseases, there is developed by the habitual use of alcoholic stimulants a marked *diminution of power to sustain injuries by disease or accident*, and a remarkable *liability* of those who indulge to *epidemic diseases*.

With the former of these positions the experience of every physician of any considerable practice is in harmony. How often are physicians disappointed at the results of diseases in cases of adults during the age when they ought to be in their prime. Many cases of fever and of many forms of inflammation, as well as almost every grade of accident and surgical operation, prove fatal unaccountably unless the habit of the subject as to the use of alcoholic drinks be taken into the account.

As to the liability of drinkers to disease as compared to sobers, W. Marcet,

M. D., F. R. S., has an interesting chapter in his work on "Chronic Alcoholic Intoxication." His tables are based upon 695 cases of out patients, carefully observed at the Westminster Hospital. Of the whole number, 695, two-thirds, or 463, were caused by indulgence in alcohol, and were preventable by abstinence therefrom.

And it will be noticed that Marcet does not frame his tables on the distinction of "drinkers and total abstainers," but upon the distinction of "drinkers to such a degree as plainly to do them injury, or to such a degree as ought to do them injury," and all others. Had his tables been calculated upon the basis of drinkers and total abstainers, it cannot be doubted that the liability of drinkers to the diseases mentioned would have been considerably increased. Dr. F. R. Lees, F. S. A., in his Prize Essay on the Liquor Traffic, says: "Drink has the characteristic of predisposing to attacks of disease and preparing the way for the winged pestilence."

Let an epidemic appear in our midst, drunkards are its earliest victims, and its ravages are most desolating in those districts where drinking prevails.

Dr. Anderson of Glasgow states as the results of his experience in the treatment of 225 patients in the epidemic of 1848-49, "I have found the use of alcoholic drinks to be the most powerful predisposing cause of malignant cholera with which I am acquainted. So strong is my opinion on this point, that were I one of the authorities and had the power, I would placard every spirit shop in town with large bills containing the words, 'CHOLERA SOLD HERE.' The comparative mortality in that epidemic he states was 91.2 per cent of the drinkers to 19.2 per cent of the sobers."

During the epidemic of 1832, it was noticed in Montreal, where 12,000 cases occurred, that "not a drunkard who was attacked has recovered, and almost all the other victims were moderate drinkers."

"In Warsaw it was found that 90 per cent of those who died of the cholera had been in the habit of drinking ardent spirits to excess; and at Tiflis, in Russia, a town of 20,000 inhabitants, every drunkard is said to have been carried off by the disease."<sup>1</sup>

#### PUBLIC OPINION OF PHYSICIANS IN THIS AND OTHER STATES.

In order to ascertain as far as I could the current opinion and observation of various members of the medical profession who are engaged in active practice, I prepared in circular form the following questions and sent them to about two hundred physicians in our own State, and about two hundred prominent physicians in other States:

1st. What percentage of sickness in adults, within your observation, is directly due to alcohol?

2d. What percentage of deaths in adults, within your observation during the last year, is due directly to alcohol?

3d. Does alcohol, in your opinion, shorten the lives of its victims, and to what degree?

4th. What percentage of inherited disease and enfeebled constitution is traceable to alcoholism in parents or ancestors?

5th. What forms of disease, in your observation, are traceable immediately or remotely to alcohol?

6th. In which parent is alcoholism most likely to transmit disease or enfeebled constitution?

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<sup>1</sup> Bacchus Dethroned. A prize essay by Frederick Powell.

7th. In your opinion, based upon your observation, are the effects of alcoholism, immediate or remote, amenable to treatment?

8th. Does your observation show that there is danger of producing the state of alcoholism by the use of medicinal tinctures or elixirs?

To this circular I have received many replies, which may be consolidated as follows:

To question No. 1 the replies varied from 1 per cent to 75 per cent, with an average of 11 per cent.

To question No. 2 they varied from 1 per cent to 50 per cent, with an average of  $13\frac{1}{2}$  per cent.

To the third question the answers varied from 5 per cent to 50 per cent, with an average of 28 per cent.

To No. 4 the replies varied from 5 per cent to very large and 50 per cent, averaging 21 per cent.

The replies to No. 5 indicate the following as diseases actually found in practice and traceable to alcohol: "Inflammatory diseases of the brain;" "apoplexy;" "many forms of paralysis;" "insanity;" "imbecility;" "diseases of the stomach, liver, and kidneys;" "all diseases dependent upon fatty degeneration;" "many skin diseases, gout, and rheumatism."

The replies to question No. 6 were nearly equally divided between "father" and "mother."

Nearly all thought the effects of alcoholism were in a fair measure amenable to treatment.

Quite a general uniformity in the replies to No. 8 shows that the medical profession do not think the danger very great of producing the state of alcoholism by the use of medicinal tinctures and elixirs, excepting when they are used in considerable quantities and for a long time, as in several cases mentioned by Dr. Wm. B. Eager, Jr., of Charity Hospital, New York, where the depraved appetite was created by the use of tinctures of cinchona and gentian. Quite a number of my correspondents spoke particularly, however, of the danger of creating the depraved appetite by the use of some of the proprietary "bitters" now in so general use. But of this danger I shall speak farther on.

But, it may be asked, if alcohol causes such a percentage of deaths among adults, why does it not appear so in our vital statistics?

The answer is that in almost all the cases of death, more or less caused by alcohol, there is some disease or accident intervening which is credited with being the real cause; and in many other instances in which persons do actually die of delirium tremens, or even from the immediate effects of an overdose of alcohol, the physician will trump up some disease, to give to the family, of a more respectable sound, and this *respectable lie* gets into the vital statistics.

In the vital statistics of this State for 1870, out of 10,766 deaths there are 14 attributed to "alcoholism." I have had the curiosity to look over the list of deaths of adults for that year which occurred in the township of Kalamazoo, and I find that out of the 64 deaths, 10 or 16 per cent, were more or less directly attributable to the use of alcoholic drinks to my personal knowledge. But in the report from which the vital statistics were compiled they were all said to have died of respectable diseases. I have no doubt that the same, or even a greater per cent, will obtain throughout the State.

#### CHRONIC ALCOHOLISM, INSANITY, DEMENTIA, EPILEPSY, AND IDIOCY.

I have purposely passed over, until now, two or three diseases or classes of disease so that, being last spoken of, the mind might rest upon them the longer,

for, although the diseases already named are exceedingly grave, yet these, affecting as they do the intellectual and the moral condition and development of the man, appear to me to challenge our more serious attention.

"There are," says Dr. Carpenter, "some individuals in whom a fit of positive madness, persisting for some time after the immediate effects of the stimulus have subsided, is brought on by every excess in drinking."

This he terms "*delirium ebriosum*." It is not intoxication, but a consequence of it; it is the *tonic* delirious excitement resulting from intoxication, while *delirium tremens* is the atonic excitement of a nervous system exhausted by long continued intoxication.

Dr. Carpenter, while discussing *delirium tremens*, says: "It is important to remark that a slighter form of this disease marked by tremors of the hands and feet, deficiency of nervous power, and occasional illusions, will sometimes appear as a consequence of habitual tippling, even without intoxication having been once produced." Marcet calls this a distinct disease, and gives it the name of "*chronic alcoholism*."

"The symptoms of the disease depend on a functional disturbance of the nervous system which may last for weeks, months, or years, even after the habit of excessive drinking has been given up." It is a degenerated condition of the man in consequence of the more or less complete saturation of the system with alcohol; a condition in which the will is weakened, while the baser appetites are strengthened; a condition of the citadel that invites the attack of the enemy by having exhausted the resources for defense. In insanity, on the other hand, we have a condition of the man still farther degenerated—a citadel in the very confusion of capture and pillage, while in dementia and idiocy the citadel is dismantled and in ruins.

"Lord Shaftsbury, after having acted as commissioner of lunacy in England for twenty years, and as chairman of the commission for sixteen years, says, having made inquiries into the matter, the result is that *fully six-tenths* of all the cases of insanity to be found in these realms arise from no other cause than from *the habits of intemperance in which the people have indulged*."

"The number of deranged people in a country corresponds very closely with the amount of strong drinks that are consumed. Till the introduction of fire-water among the American Indians, insanity was unknown. In Cairo, comparatively teetotal, there is one insane person to every 30,714 of the inhabitants. In Spain, comparatively sober, the consumption of alcohol being only one gallon per head per annum, there is one insane person in every 7,181. In Normandy, consuming two gallons of alcohol per head per annum, one in every 700. In Norway, consuming two gallons, one in 551. In England, consuming two and a half gallons, the proportion is one in every 430 of the inhabitants."<sup>1</sup>

In Michigan, where, in 1865, according to Commissioner Wells' report, before referred to, the sales of the retail liquor traffic amounted to a little more than \$45 for every man, woman, and child in the State, the census of 1870 states that there are 829 insane persons in a population of 1,184,282, or one to every 1,428. In the United States the census gives one insane person to every 1,029. While in New York, where \$56 per annum for each inhabitant were spent for alcoholic drinks, there is one insane person to a little less than 700.

I have no doubt that many other elements than the use of alcoholic drinks among the people, enter into the etiology of insanity; but certainly these fig-

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<sup>1</sup> Dr. Lees' Prize Essay on the Liquor Traffic.

ures should arrest our attention, and if possible, statistics of this kind should be verified with the misleading elements eliminated.

STATISTICS COLLECTED OF 24,789 CASES OF INSANITY AS RELATED TO INTEMPERANCE.

In reply to the following questions sent in circular form to the insane asylums of this country, I have received the following statistics of 24,789 cases of insanity as related to intemperance:

1st. In what percentage of the inmates of your asylum has insanity or epilepsy, in your opinion, been due to alcoholism in the individual?

2d. In what percentage of cases, in your opinion, is it due to hereditary degeneracy, taking its origin in alcoholism in the parents or ancestors?

3d. Is the former percentage, in your opinion, increasing?

4th. Is the latter percentage, in your opinion, increasing?

5th. From alcoholism, in which parent, is hereditary degeneracy the stronger?

6th. Does alcoholism, in your opinion, tend directly to shorten life?

7th. To what degree?

8th. Does it tend decidedly to deteriorate and exhaust the race?

9th. What other origins of the depraved appetite for drink do you recognize than alcoholism in the individual, or his parents or ancestors?

10th. Does alcoholism give origin to other forms of physical and mental degeneracy?

11th. What percentage of those persons in whom the diseased or depraved appetite takes its origin in alcoholism, either in the individual or his parents or ancestors, are, in your opinion, curable?

12th. Which class is the most amenable to treatment?

To question No. 1 I received various answers, giving the percentage of cases as from "6 to 20."

To question No. 2 I received one answer giving the percentage as "30 or more," and one other giving it as "20," while nearly all who replied at all said "no data."

To the 3d and 4th questions most of the replies were "yes," while some replied "don't know," "can't say," or "no data."

A few replied to the 5th question "mother," and a few "father," while most said "don't know," or "can't say."

To the 6th question all said "yes."

And to the 7th the answers were from "decidedly" to "25 per cent."

All said "yes" to the 8th, while from all the replies to the 9th question I gathered that "any physical degeneracy, and many unfavorable conditions, and many things which are assigned as causes of insanity, may develop the appetite for strong drink."

And nearly all the replies to the 10th agree in saying that "alcohol does give rise to various other forms of physical and mental degeneracy, such as deaf-mutism, blindness, idiocy, viciousness, and low, depraved appetites."

From the statistics of the 24,789 cases of insanity, sent me by 14 asylums, I have compiled the following:

Of all the cases of both sexes, intemperance was assigned as the cause in 7 per cent; of all the cases of both sexes, less 7,661 "unknown" or "unassigned," in 10 per cent; of all the cases of both sexes, less 7,661 "unknown" and "unassigned," and 2,006 under 20 years of age, in 12 per cent; of all the males (13,214) 13 per cent; of all the males, less 4,092 "unknown" or "unassigned,"



18 per cent; and of all the males less 4,092 "unknown" or "unassigned," and 1,085 under 20 years of age, 19½ per cent, while of all the females only 1½ per cent were attributed directly to intemperance.

I have to remark of the superintendents of the 60 asylums for the insane to which I sent my circulars, that only 14 of them replied at all, indicating, I think, that they take very little interest in the subject, or that the records of their asylums were barren of statistics, or probably both.

The replies and reports from these fourteen indicate that there is no great dependence to be placed upon their statistics of "alleged causes of insanity."

Under "intemperance" as a "cause" is included in these reports only those cases, who by personal indulgence in intoxicating drinks and beastly intoxication "known to all men," have brought upon themselves a degeneracy of the system that has had a sudden outbreak in insanity, following, perhaps, on the heels of a debauch; while there is no account taken of the degeneracy, whose outbreak may be to-day insanity, but whose origin was in the secret, moderate, but long-continued use of alcoholic stimulants, or in the drunkenness or other vice of parents or ancestors.

Of this Dr. C. H. Hughs, superintendent of the Missouri State Lunatic Asylum, says: "Few know how many alcohol directly or indirectly sends to our insane asylums. The tables of causes of insanity of these institutions do not even fully show this, for the reasons that many friends of the insane withhold the truth from the asylum record books, when they know the vice of liquor-drinking to be the real cause. In many instances, also, where alcohol is really to blame, the friends are not certain that the use of liquor has been the cause of the "business failures," and "perplexities," "domestic afflictions," "bereavements" and "infelicities," "ill health," and "nervous prostration," so often recorded as the immediate or direct causes of insanity, and they give the patient, for the sake of his friends and his character, the "benefit of the doubt." Only diligent inquiry on the part of asylum superintendents brings out the truth that liquor drinking is the root of much evil that the world in general, with all its knowledge upon this subject, knows not of,—that it is at the bottom of much of the mischief done to the human system, terminating in insanity and accredited to other causes.

"The offspring of the inebriate,—even to the third and fourth generations,—suffer for the vices of their parents. They are either dipsomaniacs, epileptics, impotents, paralytics, idiots, imbeciles, possessed of inordinately vicious, criminal, or immoral instincts and propensities, or totally insane.

"Brain changes begun through the instrumentality of alcohol in the parents are thus developed and completed in their children, conceived and born after the formation of the habit of drinking. The seeds of mental or moral defect, or of physical disease, sown in the incipient drinker, may thus remain, comparatively speaking, dormant in him through his life, but find rich soil for rapid growth to baneful perfection in his offspring."

Dr. Andrew McFarland of Oak Lawn Retreat, Jacksonville, Ill., thus writes me under date of February 2d, 1874:

"MY DEAR SIR—Your favor of the 29th ult. reached me to-day. The remark appended to your former circular was prompted more from a strong conviction that the line of your inquiry is a most important one, and likely, if followed, to educe important results to the cause of humanity, than from a consciousness on my part, of specific facts possessed, worth your present use. And I fear my present effort can aid you but little, because those of us most

impressed with the fact that the larger portion of the ills that flesh is heir to are literally visible inheritances, are yet without the data in figures that prove the conviction true.

"My own reflections on the subject have grown from the admission of nearly 5,000 individuals to two several State asylums for the insane,—a valuable field of inquiry, indeed, but almost useless because the inquiries you are pursuing come only incidentally into notice.

"The question of hereditary predisposition to insanity formed, of course, a never-omitted part of the record; but vices,—depraved habits of ancestors,—could not, for obvious reasons, come so readily within the field of inquiry. And I suspect all with the same kind of experience,—and even more of it,—must be just as barren of actual facts as I am, for the same reason.

"Now, as 'art is long,' allow me to say, in passing, that I do not think the mass of material our eleemosynary institutions enable us to gather will be worth much until records kept are in a form prescribed by legitimate enactment, and made full on these points.

"The records of insane asylums, I know, are lumbered up with facts of not the least scientific value, while nothing in them throws light on the philosophy of disease, as it affects man as a whole. It seems a science we have hardly begun to learn, though its materials are found, more or less, in every man's history, and, as I say, there seems no way to begin till penal and sanitary institutions can call for their facts *by authority*.

"The more mental disease is observed, the more its generally-assigned causes sink from view, and the great all-sufficient one of inherited predisposition assumes prominence. And I am led to say, from full thought, that *three of every four* entering insane asylums will show a blood-taint so sufficient as to put out of sight all other causes."

"Dr. Morel of France," says Dr. Story, "connected for several years with Salpetriere Hospital, where there are more than one thousand insane persons, and afterwards for several years superintendent of Mareville Lunatic Asylum, equally large, states that there is always a hopeless number of paralytic and other insane persons in our hospitals whose disease is due to no other cause than the abuse of alcoholic liquors. In one thousand upon whom I have made especial observation, not less than two hundred (20 per cent) owed their mental disorder to no other cause."

"Dr. Behics, in making a report on the physical causes of insanity in France, says that of eight thousand and eight hundred male lunatics, and seven thousand and one hundred female lunatics, thirty-four per cent of the men and six per cent of the women were made insane by intemperance." "And Motet reports among eight thousand seven hundred and ninety-seven cases of insane from physical causes, there were three thousand and forty-five drunkards."<sup>1</sup>

Dr. Carpenter quotes the report of Dr. Hutchinson of 1,900 insane patients in seven years in the Glasgow Lunatic Asylum, in which within a small fraction of 20 per cent are set down as caused by intemperance. "In one asylum in the east of London the per cent is 41." And Dr. McNish states that of 286 lunatics at that time in the Richmond Hospital, Dublin, one-half owed their madness to drinking.

There appears to be quite a discrepancy between the statistics, as given by Lord Shaftsbury, concerning the relation of insanity to alcohol, and those that

<sup>1</sup> Alcohol and its Effects. Dr. Chas. A. Story.

we have gleaned from our own asylums, bearing upon the same subject, in this country.

The discrepancy will, I think, be seen to be more apparent than real, when several considerations shall have been noticed.

In the case of insane male adults no effort has been made, or at least none has been reported, to ascertain whether they were children begotten while either parent or both were the subjects of chronic alcoholism or of intoxication. No statistics of this kind are reported either of the insane under 20 years of age. The fair presumption of this class who have become insane before many of the causes that tend to produce insanity in older persons have come to bear deleteriously upon them, is that many or most of them have some inherited degeneracy that makes them especially susceptible to any exciting causes of insanity.

Had we the statistics to show in how many of these cases the inherited degeneracy took its origin in alcoholism in the parents or ancestors, the number assigned to that cause would, no doubt, be largely increased. This is made probable by the fact that Dr. S. G. Howe, on careful inquiry into the parentage of 300 cases of idiocy, found that 145 of them were the children of acknowledged drunken parents.

Again only  $1\frac{1}{2}$  per cent of the female insane are reported as owing their insanity to intemperance. This fact, while it goes far to establish the intimate relation of causation between alcohol and insanity (for but very few, comparatively, of our American women drink habitually), would, no doubt, be greatly modified if the truth could be ascertained in respect to the hereditament of all these insane women, for, if it is established as a law of hereditament, as many writers believe, and as is very ably argued by Dr. John Stockton Hough,<sup>1</sup> that daughters resemble their fathers, while sons resemble their mothers, it follows that in a given number of insane or otherwise degenerated females, we ought to find the seeds of *their* degeneracy planted in the preceding generation of males; while in the cases of insane or otherwise degenerate males, we ought to trace the degeneracy back through their mothers to the second generation of males; so that the present generation of insane and alcoholized males will have a full representation in the next generation of insane females.

Is not the very fact that so many of the inmates of our asylums are recorded "unassigned" or "unknown," of itself suggestive that there may be in all that number a degeneracy of stock, though difficult to trace, yet surely the growth of seeds sown in preceding generations?

If these things could be fairly traced out, and alcohol had due credit for causing "business failures," "domestic trouble," "bereavements," "ill health," and "nervous prostration," which appear in the reports of asylums as the causes of so many cases of insanity, who can doubt that the percentage of cases justly assignable to alcohol would be nearly or quite equal to that given by Lord Shaftsbury for England?

From insanity produced by intemperance in the individual the road is often short and quick to dementia, imbecility, idiocy; and more especially is this true of insanity occurring as an outburst of a degeneracy whose origin was in alcoholism of parents or ancestors?

Says Dr. Sewell, "The inebriate first loses his vivacity and natural acuteness

<sup>1</sup> Law of Transmission of Resemblance from Parents to their Children. By John Stockton Hough, M. D., Philadelphia. A reprint from the Medical Record.

of perception. His judgment becomes clouded and impaired in its strength, the memory also enfeebled and sometimes quite obliterated. The mind is wandering and vacant, and incapable of intense or steady application to any one subject. In his cups the drunkard is generally a temporary madman."

But idiocy and insanity are not always temporary in the case of the drunkard. Both of these effects often become permanent in the future man.

"In some cases reason seems to be blotted out and the miserable victim of intemperance lives and dies a literal fool. In other cases, still more numerous" (and seen in almost every community), "there is a manifest approximation to idiocy where this deplorable consequence does not actually follow."

"Many a man," says Dr. Story, "has drunk himself into a fool. Many a bright boy and man of talent has become a fool while becoming a sot."

#### WHAT DOES THE DRUNKARD BEQUEATH TO HIS OFFSPRING?

The degeneracy by no means stops with the man himself. By a law of nature, running through the animal as well as vegetable kingdoms, "like begets like;" "they shall bring forth seed after their kind." "Traits of character, dispositions, aspirations, talents, propensities, passions, depraved conditions and diseases, may be inherited as well as form, looks, and complexion."

In accordance with this law drunkenness in the parents has a special tendency to produce *mental debility, low and depraved appetites, weakness of will, loss of moral sense, vice and crime, insanity and idiocy* in the offspring."

"Looking to the decided tendency to hereditary predisposition in the ordinary forms of insanity," says Dr. Carpenter, "looking also to the fact that any perverted or imperfect condition of the nutritive functions established in the parent, are also liable to manifest themselves in the offspring (as shown in the transmission of the gouty and tubercular diathesis), we should expect to find that the offspring of habitual drunkards would share with those of lunatics in the predisposition to insanity, and that they would moreover be especially prone to intemperate habits."

That "one drunkard begets another," as Plutarch says, may be proven by common observation and by many recorded opinions and observations. Dr. W. A. F. Brown, the resident physician of Crichton Lunatic Asylum at Dumfries, makes the following statement: "The drunkard not only injures and enfeebles his own nervous system, but entails mental disease upon his family. His daughters are nervous and hysterical; his sons are weak, wayward, eccentric, and sink insane under the pressure of excitement of some unforeseen exigency, or of the ordinary cares of duty."

Dr. S. G. Howe, of Boston, in a report to the Massachusetts Legislature, says: "The habits of the parents of 300 idiots were learned, and 145, or nearly one-half, are reported as known to be habitual drunkards. Such parents, it is affirmed, give a weak and lax constitution to their children, who are consequently deficient in bodily and vital energy, and predisposed by their very organization to have cravings for alcoholic stimulants. Having a lower vitality, they feel the need of some stimulation. If they pursue the course of their fathers, which they have more temptation to follow and less power to avoid than the children of the temperate, they add to their hereditary weakness and increase the tendency to idiocy in their constitution, and this they leave to their children after them." Dr. Howe, in a letter dated February 20th, 1874, confirms his opinion above given, by his subsequent observations.

"There is," says Dr. Carpenter, "a prevalent impression that idiocy is particularly liable to occur in the offspring when the conception has taken place

when one or both of the parents were in a state of intoxication." He quotes a striking example: "Both the parents were healthy and intelligent, and one, at least, habitually sober; but both were partially intoxicated at the time of the intercourse, and the offspring was completely idiotic." "There is," he says, "every reason to believe that the monomania of inebriety not only acts upon and renders more deleterious whatever latent taint may exist, but vitiates and impairs the sources of health for generations."

There has been sent me by one of my correspondents two sad illustrations of this terrible inheritance: "Five children were born in one family in Yates County, New York, all of whom were idiots, and two children idiots in Steuben County, New York, whose parents acknowledged that they were intoxicated when the conceptions took place."

Dr. Chas. A. Leas, of Baltimore, sends me the following: "A boy in New York was born drunk: *i. e.*, from his birth he had an irregular, unsteady muscular action. The boy was in after years arrested for being drunk in the streets, and in the judicial examination it was proven that he had been so from his birth, and had inherited it from his father, who was a most terrible and habitual drunkard. In short, it was shown and testified to by his mother that he had been born drunk and remained so."

I have myself frequently seen a girl upon the streets, now nearly or quite 18 years old, whose movements are, and have been from her birth, almost precisely those of a man so drunk that he can with difficulty reel along; and her countenance bears the idiotic expression of that condition. Her father, who has since died of delirium tremens, is believed to have been beastly drunk when she was begotten.

Dr. Chas. A. Story relates a case of "the first of seven children that was a complete idiot. Both parents were beastly drunk at the time of this child's conception. They quit drinking and the other six children have inherited about average intellects."<sup>1</sup>

He relates another case in which "the first child has average common sense; the second is very much demented; and the third is a slobbering, drooling fool. The explanation is easy. After marriage the parents began drinking, and in six years had become perfect sots."

But it is not alone in the condition of actual intoxication that such fearful conditions are entailed upon the offspring. But we have, alas! too many illustrative cases among the moderate but regular drinkers of the "best liquors."

Sometimes children who have appeared to be fairly endowed in early childhood surprise their parents and friends, at or near the age of puberty, by the sudden outcropping of their inherited feebleness and imbecility.

<sup>2</sup>"A young man at the age of nineteen years was taken to the insane asylum at Mareville for mental derangement caused by excess in alcoholic drinking. As the inheritor of a good fortune, he received every attention and care in his early life, but they produced no effect on a perverse and obstinate nature, whose instincts were of the most cruel kind. When but three years old he was the terror of all the children in the neighborhood, whom he subjected to incredible tortures in the absence of older persons who would have restrained him. His chief pleasures of boyhood were in destroying and torturing animals. This young man had for his father a person who moved in educated society and filled important offices, but who was for a long time intemperate, concealing, how-

<sup>1</sup> Alcohol: Its Nature and Effects.

<sup>2</sup> A case related by Dr. Morel as quoted by Dr. John Bell in his report to the American Medical Association in 1869.

ever, the fact from the public eye. He had five children, only one of whom survived infancy, and he was the unfortunate being now described. Edward, as he was called by Dr. Morel, evinced in his tender years a great fondness for drawing and reading, and after a time was placed at college; but his teachers soon perceived that all their efforts were in vain, and that this boy, both in body and mind, was afflicted with an arrest of growth; his head was microcephalous and his intellect limited. On his return home he went rapidly through successive stages of degeneration by continual debauchery, until, fortunately, he was placed under restraint in an asylum. This young man labored under the double curse, first, of inherited predisposition, and secondly, of the example given to him by his father's excesses."

"Morel exhibits a picture of progressive degeneration of alcoholic origin, and its continuance in a family until it ended in the extinction of the latter, at the fourth generation. In the first generation there was immorality, excess in alcoholics, moral debasements. In the second, hereditary drunkenness, maniacal attacks, general paralysis. In the third generation, sobriety, hypochondriac tendencies, lupomania, systematic belief in persecutions, homicidal tendencies. In the fourth, limited intelligence, a first attack of mania at sixteen years of age, stupidity, transition to idiocy complete and incurable."

The following cases were sent me by Dr. Wm. B. Hazard, medical superintendent of St. Louis County Lunatic Asylum, in reply to circular:

"Mr. N——. No alcoholism in ancestors so far as known; a very hard drinker in his earlier manhood. His first three children, boys, were idiots,—idiocy almost complete. Mr. N. now reformed. His next son was bright but dissipated,—had to flee the country for forgery. Two daughters and one son followed, all of whom were excellent people."

"Two gentlemen named S——, now in middle life, both very hard drinkers. One has been in asylum many times with *mania a potu*; the other given to sexual excesses, adultery, etc. Their mother was a bastard and addicted to drink. One daughter of the first lewd, the other children not yet adult."

Dr. H. F. Lyster of Detroit kindly sent me the following:

"The father lived to be 48. He was of healthy stock and fine physique, had an excellent mind, was high bred, and educated to a profession. He had been brought up a moderate drinker, and during the last fifteen years of his life had been a very hard drinker, and the last seven years of his life an habitual drunkard, and mentally and physically disabled by alcoholic stimulants. It was during these fifteen years that most of the children were born. The mother lived to be 87 and has had thirteen children, and much care and work until within twenty years of her decease. She possessed a strong, healthy mental and physical constitution, much superior in both to the majority of people of the best class. Her mental and physical superiority existed until death. She was a total abstainer.

"Of the thirteen children, five died in infancy or early childhood of causes unknown to the writer, and were among the earlier children. Of those reaching adult life, one son died from accident at 22, healthy bodily and mentally, and not intemperate; one daughter of heart disease at 18, mentally bright; and one son died of softening of the brain at 45, after a three years' illness. One daughter has had chorea for years of an aggravated character, wholly unfitting her for society and rendering connected conversation impossible. Her age is 62. One son shows symptoms of approaching mental debility, at 59. One daughter nervous and near-sighted at 56. One son has had partial paralysis

and softening of brain at 52. One son a confirmed drunkard, now 46. One daughter nervous, eccentric, and very near-sighted at 44. All were near-sighted.

"The men were all, with the exception of the one which died at 22 and the one now a confirmed drunkard, moderate drinkers. Previous to accidental death of one and the premature decay of the others, all were men of superior ability, education, and attainments, and were of excellent physique."

Case II. "Mother, English, a healthy, hard-working woman of 50, of low mental organization and small head; had three sons, one, the oldest, almost '*non compos mentis*,' aged about 30, has epilepsy, no education; one of medium intelligence but not bright, aged 28; and one of very low degree of intelligence, no education, aged 24 years. The father died from apoplexy,—a man of good physique, but had been a hard drinker for years."

On this subject Dr. Andrew McFarland writes me as follows:

"Some instances occurring to me are very interesting. I know one old New England family line in which insanity has existed now for the fifth generation, not less than 150 individuals having been victims of that inheritance.

"When Dr. Bell of the McLane Asylum and myself were in charge of neighboring institutions, we could always count among our patients eight or ten out of this original family stock; and yet it produced persons of eminent ability, from President of the United States downward.

"In such notable instances there will be a great infusion of cases of dipsomaniacs, besides hard drinkers not classed as diseased.

"I thus believe,—though I cannot show facts absolutely to prove,—that these predispositions often date from some vigorously constituted individual, who ingrafted on the stock habits of inebriety. To show how and when vicious infusions get into an originally pure stock; as, for instance, in the case of the great and good Jonathan Edwards, some of whose descendants had a distinction in profligacy as great as his own for the opposite, would be interesting and profitable if we had the facts. But I believe the greatest disasters to blood come in on the female side; for it seems next to impossible for a dipsomaniac mother to have a progeny not very largely vitiated. It is only to cite common observation how liquor-drinking, opium-eating, and sexual excesses and looseness, cling as habits to certain families; a fact not all explainable on a theory of mutual example. If we could trace back, we should, I imagine, find the exact generation where the ruling vice came in, as we could where the royal house of Austria got its distinguishing lip, or the Bourbon his nose.

"It is your stout old hero, who goes to bed every night with liquor enough under his belt to fuddle half a dozen ordinary men, and yet lives out his three score years and ten, that will be found at the fountain head of the stock that pours into the world, generation after generation, such a crop of lunatics, epileptics, eccentrics, and inebriates as we often see. The impunity with which one so constituted will violate all physical law gets its set-off in a succeeding generation, when the great harvest begins.

"That 'the iniquities of the fathers are visited upon the children, that the fathers have eaten sour grapes and the children's teeth are set on edge,' are truths that no scripture is needed to teach. In other words, he who sins through physical excess does not do half the harm to himself that he does to the inheritors of his blood. The penalty *has got to be paid* as sure as the obligation of Faust to the Evil One."

Several of the superintendents of insane asylums have stated, in answer to

the fourth question in the circular sent them, that the proportion of insane persons whose insanity appears to take its origin in an hereditary degeneracy from alcoholism in the parents or ancestors is increasing.

This may be only an apparent increase owing to the more careful scrutiny with which this very question is investigated, or it may be a real increase from the greater age of the nation, and the longer indulgence in alcoholic drinks by certain families, in whom the taint of blood becomes stronger in each succeeding generation. Indeed, is not the greater proportion of insane persons in the older States, as New York and Massachusetts, mainly to be explained in this way?

As the Western States grow older, will not such examples of entailed degeneracy in families or clans, as related above by Dr. McFarland, become common unless the very source of the degeneracy be dried up?

If this reasoning be true, it is not surprising that in England and Scotland, where for several centuries almost all the people have been habitual drinkers, and where the taint of blood, though very small three or four centuries ago, has been constantly deepening from generation to generation, there should be very many families giving a similar or even a darker history in respect to insanity, than the New England family above mentioned, while other families may have long ago, from the same cause, become extinct?

In this way it is easily to be believed that the proportion of insanity traceable to such degeneracy might be indefinitely increased.

Is not the very fact that after several generations such degenerate families do become exhausted, the very salvation of the race?

Says Dr. S. G. Howe, in answer to a question in the circular: "Families are exhausted and become extinct, but not the race."

Thus the fearful judgment pronounced by God, "I will visit the iniquities of the fathers upon the children to the third and fourth generation," while it contains a condemnation and punishment for the sins of individuals and families, inherent in the very laws of physiology; contains, also, a merciful provision for the perpetuity of the race, in that it hints that the tainted blood and degenerate stock shall, after so many generations, become extinct and give place to others, and the accompanying benediction pronounced upon the righteous appears to warrant this interpretation.

#### DOES ALCOHOL SHORTEN THE LIVES OF THOSE WHO HABITUALLY DRINK IT?

From what has preceded, this question might very safely be answered in the affirmative. But in making up the case against alcohol, it is my purpose to establish every position by well authenticated facts or the conclusions of those whose business it has been to collect and collate such facts.

And here we are indebted largely to insurance companies and their actuaries for many facts bearing upon this question.

<sup>1</sup>"Thus the policies issued by four of the principal officers (in England) amounted to 6,153, and the number of deaths during a given period to 117, being an average of almost 20 deaths to 1,000 members. During the same period the Temperance Provident Institution issued 1,596 policies and had only 12 deaths, or  $7\frac{1}{2}$  per thousand, being nearly one-half less than the deaths in the most healthy non-temperance offices, as follows:

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<sup>1</sup> *Bacchus Dethroned. A Prize Essay. By Frederick Powell.*



1st office issued 838 policies; had 11 deaths; 13 to 1000.

2d " " 1,901 " " 27 " 14 "

3d " " 944 " " 14 " 15 "

4th " " 2,470 " " 65 " 26 "

T. P. Inst. " 1,596 " " 12 " 7½ "

"In the government returns of the sickness and mortality of the European troops forming the Madras army for the year 1849, in which the men are classed as *total abstainers*, *temperate*, and *intemperate*, the results are highly favorable to the total abstaining soldiers. Of 450 *total abstaining* soldiers the rate per cent of admission into hospital for treatment of various diseases was 130.888. The rate per cent of deaths was 1.111. Of 4,318 *temperate* soldiers the rate per cent of admission into hospital for treatment of various diseases was 141.593. The rate per cent of deaths was 2.315. Of 942 *intemperate* soldiers the rate per cent of admission into hospital for treatment of various diseases was 214.861. The rate per cent of deaths was 4.458. 'From these it will be seen,' says Dr. Carpenter, 'that whilst the number of deaths among 450 *total abstainers* during the year was 5, or 11.1 per thousand, the number among 4,318 *temperate* men was 100, or 23.1 per 1,000, being rather more than *double* the previous proportion. As to the *intemperate* the increase is frightful, for among 942 such men the number of deaths was not less than 42, or in the *quadruple* ratio of 44.5 per 1,000.'

Dr. Willard Parker, of New York city, late President of the New York State Inebriate Asylum, in "Statistics of Inebriety," gives the results of the distinguished English actuary, Mr. Neison, who took a prominent part in investigating the influence of inebriety upon the risks of life insurance companies, both in this country and abroad, as follows:

1st. When in a given number of risks *ten temperate* persons die between the ages of fifteen and twenty inclusive, *eighteen intemperate* persons die.

2d. When in a given number of risks *ten temperate* persons die between the ages of twenty-one and thirty inclusive, *fifty-one intemperate* persons die, or the risk on an inebriate is more than *500 per cent greater* than on a temperate person.

3d. When in a given number of risks *ten temperate* persons die between the ages of thirty-one and forty inclusive, about *forty intemperate* persons die, or the risk is *increased 400 per cent*.

A person's chances of living at the various ages are given as follows:

At 20, the expectancy of a temperate person is 44.2 years, of an intemperate person 15.6. At 30, the expectancy of a temperate person is 36.5 years, of an intemperate person 13.8. At 40, the expectancy of a temperate person is 28.8 years, of an intemperate person 11.6.

These statistics and tables give an emphatic answer, *that alcohol does shorten the lives of its consumers*, and fully justify the average per cent (28) given in the answers of physicians to the 3d question in the circular.

On account of the great length to which this paper has already come, I shall pass over the *relation of alcohol to accidents and the accidental destruction* of human life with simply an appeal to the common observation of men to justify my charge that more than one-half of all the accidents occurring in the year, by sea and land, are chargeable more or less directly to alcohol.

In respect to *its relation to vice,—the social vice,—and the disease that is sown by and feeds upon it*, almost every physician can bear testimony, that, in a large majority of cases, suffering from venereal diseases, the testimony of the

victim is, "I drank, and when my passions were inflamed, my moral sense blunted, my conscience overwhelmed, and my will dethroned, I was led to the house of her 'whose steps take hold on hell.'"

For brothels to flourish, they must either keep liquors themselves or be located close to a drinking saloon.

Not one in ten of these places could be kept up for a year, were it not that the baser passions of men are inflamed and unbridled by alcohol in or near them.

I have no heart to describe the woeful inheritance of diseases in body, mind, and soul of the children of parents in whom the poison of syphilis is mingled with that of alcohol.

But I cannot refrain from referring to some statistics showing *the relation of alcohol to crime*.

<sup>1</sup> "Mr. Simmons, governor of the Canterbury prison thus writes: 'The number of prisoners who have been committed to the prison with which I have been connected during the last fifteen years amounts to 22,000; among whom I have never met with one being a teetotaler.'

"From the experience I have had I calculate that from 90 to 92 per cent. of all crimes are committed through taking intoxicating drink, in a direct or indirect way.'

"The Rev. W. Caine, M. A., late chaplain of the Salford Hundred Jail says of 296 female convicts, 165 confessed that they were drunkards; of 704 males 480 admitted that they were drunkards."

The chaplain of the Massachusetts State's Prison testifies "that 19 out of every 20, confined within these prison walls were there for crimes committed through the agency of liquor."

Almost all our judges of Police Courts will coincide with the English Judge Coleridge, who says: "There is scarcely a crime that comes before me that is not, directly or indirectly caused by strong drink," and Judge Wightman, when he says "I find in every calendar that comes before me one unfailing source, directly or indirectly, of most of the crimes that are committed—*intemperance*."

Abundant statistics are at hand to show that the amount of crime varies in close ratio with the amount of liquors drank by a people. To only two such facts will I now allude.

<sup>1</sup> "In England and Wales during the four years succeeding 1820, the consumption of spirits amounted to 27,000,000 gallons, and the number of criminals committed for trial was 61,262. During the eight years from 1824 to 1832 the committals had increased 50 per cent and the consumption of spirits 77 per cent."

"In Scotland" says Dr. Nott, "in 1823 the whole consumption of intoxicating liquors amounted to 2,300,000 gallons; in 1837 to 6,776,715 gallons. In the meantime crime increased 400 per cent, fever 1600 per cent, deaths 300 per cent, and the chances of human life diminished 44 per cent."

"In 1840, owing to the great Temperance Agitation conducted by Father Mathew, the public houses within the police bounds of Dublin had lessened by 237, and the prisoners in the Richmond Bridewell, which had numbered 136 on the first of September 1839, were reduced to 23 on the sixth of November 1840."

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<sup>1</sup> Powell's Prize Essay.

"Lord Morpeth, when Secretary for Ireland, gave the following statistics in a speech on the condition of Ireland, delivered after a public dinner in Dublin. Of cases of murder, assault with attempt to murder, outrageous offense against the person, aggravated assault, cutting and maiming, there were in 1837, 12,096; 1838, 11,058; 1839, 1,097; 1840, 173.

"Of persons charged with murder within the police bounds of Dublin, in 1838, 14; in 1839, 4; in 1840, 2; in 1841, 1.

"The Temperance Agitation commenced in 1838, and by the tenth of October Father Mathew had inscribed on his roll of Teetotalers 2,500,000 names, and the consumption of spirits had decreased for the year 1840 by 5,000,000 gallons."

In the annual report of the Inspectors of the State Prison of this State, for 1873, I find that of the 655 prisoners remaining in the Prison at the close of the year 305 or 46.57 per cent were intemperate; 143 or 21.83 per cent were moderate drinkers; 207 or 31.60 per cent are said to be "temperate."

I instituted an inquiry of the agent to learn if possible what per cent of the prisoners were the children of intemperate parents; but was sorry to learn that no such statistics had been attempted. If such statistics could be secured it would throw a flood of light upon the question as to whether the tendency to crime is inherited as an entailment from alcoholism in the parents or ancestors, and, I have no doubt, would show that, directly or indirectly, alcohol sends 90 per cent of the inmates to the State Prison.

*Alcohol is chargeable with, by far, the greater proportion of pauperism.*

Statistics are not wanting to demonstrate this proposition, but it really seems needless to advance them, when we consider the vast amount of money that is spent for intoxicating drinks, the immense number of days that are squandered in its use, the sickness that it produces, the constitutions that it breaks down, the loss of hope, courage, self-respect, as well as the respect of others, that it begets the degeneracy of the whole man that follows its use, and above all the physical, mental and moral degeneracy that it entails upon the children of its victims.

In reply to the question "in what percentage of cases, in your opinion, is the depraved appetite of the inmates of your institution, due to hereditary degeneracy, taking its origin in alcoholism in the parents or ancestors," Dr. Albert Day, late Superintendent of Binghamton Inebriate Asylum, says: "This class of inebriates are seldom found in our reformatory institutions. They are oftener found with the criminal classes and pauper establishments. They seldom seek reformatory influences. They are usually degenerate in mind and body,—never aspire above a life of dependence, and find only agreeable companionship with the low and vicious."

From this class our poor-houses are largely filled.

My pen would certainly fail to portray the suffering, want, crime, misery, and degradation that alcohol causes to the people of Michigan.

I know that I have made a fearful indictment against alcohol; but, fully sustained by the facts, as I believe, it abundantly justifies me in bringing it, with some of its proofs, before you, and, through you, before the people of this State. Indeed, this Board would be recreant to its sacred duties if it did not faithfully publish these facts to the people; and will largely fail in the objects for which it was created, if it does not propose some means by which, if followed, these great and terrible burdens and curses upon a people may be escaped from.

Let me briefly summarize the indictment: Alcohol destroys a vast amount of the money of the people; squanders for the people of the State, in one year, hundreds of years of valuable time; it vitiates the blood, diseases and enfeebles all the organs of the bodies of those who use it; dethrones their reason; debases many to a lower level than the brutes; from intelligent, reasoning beings, it makes men drivelling idiots; makes men more susceptible to, with less power to resist, disease; begets in men a disease that enervates and destroys the will, overwhelms the conscience, and perverts the moral sense, entails upon their children every form of physical, mental and moral degeneracy,—makes them insane; makes them criminals; makes them idiots; exhausts the vitality, physical and mental, of whole families, and causes them to become extinct; causes more sickness and deaths in adults and children, than any other,—yes, than *all other* preventable causes of sickness and death; it fills our insane asylums, our hospitals and our alms-houses; fills the land with crime, our reform schools, houses of correction, jails and State prisons with criminals; brings a large proportion of the taxes upon the people; and gives in return, nothing but the gratification of an animal appetite that grows more sensual every day.

In view of these tremendous and portentous evils what ought this Board to do?

Carbon oils that do not stand a fire test of 150° are condemned, and this Board has done its plain duty in pointing out the danger of such oils, and the fact that manufacturers and their self-styled inspectors have been guilty of the grossest frauds in sending to Michigan oils far below the standard, and that endanger the people of the State with a dozen or twenty explosions in a year, killing or horribly disfiguring as many persons, and destroying, perhaps, as many thousand dollars worth of property: And this *is* our duty; it is right,—the people approve.

Wall paper with Scheele's green upon it, endangering a few families and killing perhaps a half dozen or so, persons in a year, has been tabooed by this Board, and labeled "poisonous"—"dangerous to life." Waters are analyzed, and the air of school-rooms tested, to warn against impurities that insidiously implant the seeds of disease in old and young; filthy streets, reeking cess-pools, and unclean slaughter-houses are declared nuisances, lest they breed disease and prepare the way for the winged pestilence; and the people say *it is well*,—so let it be.

Shall we have nothing to say upon these direful and destructive effects of alcohol, so wide spread among the people, and reaching onward by their baneful influence, to the third and fourth generation,—even to the extinction of whole families?

*"God's great remedy for the world's great CURSE, is total and universal abstinence from making, selling and drinking intoxicating liquors."*

Is a man with no vitiated tastes, and no inherited degeneracy, physical, mental or moral, perfectly safe from the horrid brood of evils of this demon?

Such a man does not *love* alcoholic drinks; he must *learn* to drink them. But his only safety is in always totally abstaining from them, for habitual indulgence in them, even slightly, vitiates his taste and begets a diseased appetite.

Can a young man who, from some taint of blood, has inherited from his parents or ancestors that morbid desire for stimulants, be secured from this brood of evils? Yes! if the taint of blood is not so strong as to wholly

enervate the will; but he, only, by totally abstaining. And is it not possible, that, by so doing, and by intermarrying with a person in whose blood there is no such taint, he may do much towards eliminating that taint from his descendants?

But there is a large class of persons who have inherited such a taint of blood, and such a degree of degeneracy of stock, that their moral sense is blunted, and their wills overwhelmed by a depraved and demanding appetite, whenever they are in the presence of alcoholic drinks. Such persons can be kept from drinking and still further vitiating their constitutions, and bringing still deeper degeneracy upon their offspring, only by removing them from the *temptation*, or the temptation from *them*.

Again there are those, who, originally from undegenerate stock, have by former indulgences in drink generated within themselves a diseased condition, alcoholism, that declares itself, in one way, by an inordinate appetite for drink, which makes a slave of the will, and renders it morally certain that they will drink if the temptation is still before them.

Now the State, as a law-making power, appears at first sight to have done its duty by these classes of persons to protect them from the direful temptation, for in the Constitution the Legislature is prohibited from granting a license for the sale of intoxicating drinks, and the Legislature itself has repeatedly passed enactments prohibiting their sale under pain and penalties. But the fault is with communities,—with society,—that the laws are mostly a dead letter, unexecuted. Can this fault be obviated, and how? *This is the inquiry of to-day.*

*Does the State or Society owe to a certain class of its citizens Inebriate Asylums?*

While, by the silent approval of society, if not by the authority of the State, alcoholic drinks are more freely, abundantly and conspicuously offered for sale than bread-stuffs, meats or groceries, there will always be a large class of citizens in whom the disease, *alcoholism*, has already developed insanity, or imbecility, and another large class upon whom this disease in their parents, has entailed a degeneracy cropping out in all forms of defectiveness and crime. For these poor victims of the consequences of this disease, the State is already providing asylums, alms-houses, jails and prisons. But there are hundreds of men and women, now in this State, afflicted with this disease, alcoholism, in whom, as yet, insanity, as it is commonly understood, has not been developed, and whose degeneracy is not hopeless, but in whom, if neglected, the very worst consequences will follow.

Their appetite for drink is depraved, keen and clamorous; their wills are enervated and powerless, yet their better natures summon them, often with really strong desires, to go back and escape from the toils of the destroyer; but alas! in the constant presence of the tempter they are powerless to retrieve their lost condition.

Does the State or society owe anything to such men?

I am no defender of that sickly sentimentalism and shallow ethics that would consider all drunkenness, all indulgence in alcoholic drinks, evidence of a disease that makes the man or woman more to be pitied than blamed; neither am I a believer in that silly casuistry that would consider the fact that so many persons drink alcoholic stimulants evidence that there is a divinely implanted desire and need for such things, and that the yielding to such desire moderately is *no sin*, if not positively a virtue.

That this morbid desire for stimulants comes to some men as a direct inheritance from drinking parents or ancestors, who themselves had no such inheritance, is true; that it is in some men, depraved in all their instincts, on account of some inherited degeneracy of stock, is also true; while many men create that appetite by indulgence in drink, under the social customs of society, or on account of some unfavorable physical conditions. Certainly in most of the cases the depraved appetite may be traced back through the generations until it first started in unmitigated sinful indulgence.

But the real practical question is not, "who did sin, this man or his parents?" but, being diseased, can the disease be stayed and he be restored again to society and to usefulness as a citizen?

If the State or society permits the free exhibition and sale of alcoholic drinks to these men, there is, certainly, due to them, that Inebriate Asylums be at once established where they may be restrained and kept from temptation until nature, assisted by careful hygienic and skillful medical treatment, restores to them the equilibrium of their being, brings back their self respect, and re-establishes their wills. This would seem, indeed, to be but simple justice. *Man is his brother's keeper.* From Eden all along through the ages, has been ringing in the ears of society the voice of God, "Where is Abel thy brother?"

That a considerable proportion of such diseased persons, may, by restraint and seclusion in such an institution for a considerable length of time, be restored to themselves and to their families and society, is, I think abundantly proven by the reports of the Inebriate Asylums already established in this country.

In reply to a circular which I sent to these institutions, I received the following answers to this question: "What percentage of those persons, in whom the diseased or depraved appetite takes its origin in alcoholism, either in the individual, or his parents or ancestors, are, in your opinion, curable?" From one,—“at least three-fourths;” from another,—“every man in whom the depraved appetite has resulted in alcoholism, who will use his *will power*, and has proper influences around him *which he will accept*, can be cured;” and from a third,—“very small indeed;” and from a fourth,—“thirty per cent, if time is given and all appliances continued.”

And in reply to the question "which class is the most amenable to treatment?" the replies indicated that "more success was attained in the restoration of those who had contracted the disease from the indulgences in social life, in distinction from those who habitually drank alone," and in the "habitual" as distinguished from the "periodical" drunkards.

I was surprised at the small percentage of cases in these institutions, in whom the depraved appetite is due to hereditary degeneracy, taking its origin in alcoholism in the parents or ancestors, "five" or "ten" per cent. But Dr. Albert Day's note upon this point, before quoted, appears satisfactorily to explain it.

But as is manifest from the reports of these gentlemen, and also from the nature of the case, Inebriate Asylums can reach but a very small proportion of the victims of alcohol, and can fully antidote none of its baneful efforts. I do not believe the depraved appetite can ever be wholly eradicated, and no sooner does the reformed and restored inebriate leave the asylum than all the temptations that formerly surrounded him, are again weaving their, almost necessarily, fatal spells around him until he again falls and is a hopeless, helpless, ruined man.

Contemplate this fearful and absurd circle; society permits, and by its silence, upholds, the means that make Inebriate Asylums a part of her duty to citizens, and when she has done this duty she sends the restored man back to the same means, that by them "the second state of that man may be made worse than the first."

Although society may have attempted to pay some of its obligations to these unfortunate citizens, has she by that means discharged her duties to herself? Does she intelligently obey the first law of nature?

A few of the diseased ones are cared for, it is true, but the fountain from which flows the ever widening stream of disease and death is not stopped, nor has there been any attempt to cleanse its stygian waters, or set bounds to its demon-inhabited waves, or limit its horrid brood of evils.

I am sure that the moral sense of the people of Michigan will not be satisfied, nor will the evils of intemperance be considerably stayed until society shall every where throughout the State, rise up in its might and smite King Alcohol; utterly dethroning him; driving him, where he always should have been, to the place of a drug; a medicine or an adjuvant to the arts.

That so desirable, salutary, and just a condition of affairs can be brought about at once, I am not sanguine enough, for one moment, to expect. For its accomplishment there needs the united, continuous, and prolonged effort of all who see and deprecate these evils, and who study the well-being of society and the nobility and perpetuity of the State.

#### AMOUNT OF MONEY RECEIVED PER ANNUM FOR ALCOHOLIC LIQUORS.

Let us look for a moment at the strength of the enemy with which we have to deal, and count some of his resources.

The amount of the retail sales in alcoholic drinks in this State for the year 1865 are given by the Commissioner of Internal Revenue for that year as \$52,874,170, and this vast sum was distributed among, say, 10,000 dealers. Now nearly or quite one-half of this sum was profit, *i. e.*, over and above the cost of the liquors,—\$26,000,000 per annum upon this single business!

One-half of this vast sum would at any time be used as a corruption fund, if necessary, to defend and protect the other half; this sum, used by intelligent, determined men, makes an enemy of no small power or despicable resources. The influence of this money arrays for the defense of this traffic, not the dealers in intoxicating drinks and their immediate dependents alone, but many, very many, others, who with pharisaical pride "thank God that they are not so depraved and unmindful of the interests of society as these publicans," and yet, seeing some personal interest in this vast sum of gain from this business, are unwilling to say or do aught against it. The bankers receive the deposits of these dealers and dare not be known as opposers of the liquor traffic; the lawyer and the doctor count many of their clients or patients among the dealers or their victims; the merchant, tradesman, the mechanic and the daily workman, all fear to plant themselves in open declared opposition to the dram-selling business, lest their own revenues be curtailed. The great and prevailing cry is, especially in large villages and cities, "put down the traffic in alcoholic drinks, and you destroy a large portion of the industry of the people, and blot out at once, even for the State of Michigan, a business that brings to the people of the State a profit of \$26,000,000 per annum."

As in an ancient city, when the apostles of a pure and elevating Christianity proclaimed its life-giving principles to the people, men who had their wealth by a certain occupation were able to induce a whole city to cry out "Great is

Diana of the Ephesians," so, to-day, for precisely similar reasons are many found to join in the cry "Great is King Alcohol, and the business that it gives to a community." The cry of to-day is just as base and specious as that in Ephesus 1800 years ago. And yet this very cry is the reason why in our large villages and cities the prohibitory law of the State is not executed. Its speciousness will be seen from the fact that not one-fourth of the intelligent men who join in it but will confess that if alcoholic drinks could in one month be driven from the community, society would move on far more prosperously, and all that money and industry be employed in occupations that would vastly increase the business of the place and bring far more real profit to the people.

Money, then,—the \$26,000,000 per annum,—with all its varied and wide spread influence, constitutes the enemy's means of defense.

As men are constituted, those who have waged war against alcohol and its traffic, must bring the same weapons to bear against it that are used in its defense.

As the "*almighty dollar*" is the only argument that can reach many men upon this question, this argument must be theoretically and practically urged until it is demonstrated, and men are made to *feel* that to sell rum is not only disgraceful and outrageously sinful, but is, actually, a pecuniary loss to individuals and to communities.

While society permits this business to be carried on in spite of the position of the State, as shown by her constitution and her prohibitory enactments, its evil effects can, and ought to be limited and mitigated in various ways, some of which I shall endeavor to point out.

The baneful influence which so-called, "patent medicines," and especially those bearing the name "bitters," have in securing recruits to the great army of inebriates, is a matter of common observation, and has been mentioned in numerous answers to the circular to physicians.

Some men drink these vile compounds, it is true, intelligently, thinking it a concealed, or an excused way of taking whiskey,—but many others, somewhat ailing, and for whom a neighbor, or, perhaps a lazy or ignorant doctor has recommended some "bitters," take them in ignorance and continue to do so until the depraved appetite has been generated and fixed, and the way down to confirmed inebriety is straight and swift.

That I might speak intelligently upon this point, I have requested Prof. R. C. Kedzie to make an analysis of two specimens of these "bitters." I give his analysis below:

LANSING, Feb. 4, 1874.

*H. O. Hitchcock, M. D., President of State Board of Health:*

DEAR DOCTOR:—I have examined a bottle of "Drake's Plantation Bitters," and find it contains 36½ per cent of alcohol.

I have also examined a bottle of "Hostettters' Stomach Bitters," and find it contains 40½ per cent of alcohol.

Very respectfully,

R. C. KEDZIE,

*Member of State Board of Health.*

The doctor adds, "It is horrible to think that the sick and feeble should be beguiled by the promise and hope of health to resort to the use of these "bitters"—persons, too, who would recoil from the habitual use of whiskey and rum. Yet if they use these bitters *according to directions* and follow this course for any long period of time, they are unwittingly on the road to drunkenness. Any one would recognize this danger if advised to take "a wineglass-



ful" of whiskey or rum before each meal, but when they do the same thing *unwarned*, they still run the same perilous course so far as the establishment of the alcoholic appetite is concerned.

Drake's Plantation Bitters purports to be St. Croix Rum, with "Calasaya bark and other roots and herbs." It contains 36½ per cent of alcohol, or a pint of poor rum, and four ounces of other material for flavoring, etc. Its use as a morning appetizer, old soakers will fully appreciate.

Hostetter's Bitters is worse than Drake's, as it contains more alcohol and that more nicely disguised with sugar and aromatics. Twenty ounces (a bottle) of Hostetter contains the alcohol of one pint of whiskey."

Is it not the duty of this Board to recommend to the Legislature to pass a law requiring that the manufacturers of all such "bitters," if they are to be sold at all in this State, should put conspicuously upon their label of each and every bottle the exact per cent of alcohol in its contents? This would compel these vile compounds at least to take their places with alcoholic drinks where they belong. Let the failure to so label each and every bottle of such medicines sold within the State be visited with condign punishment, both upon the manufacturer and upon the seller.

The Legislature has wisely passed an act to prevent the advertisement and sale of drugs and medicines designed to produce criminal abortion; but shall the State put such obstacles in the way of a woman who would prevent herself from becoming the mother of a child by a debased and drunken husband with all the possibilities attaching to that child of being idiotic, insane, a criminal from inherited predisposition, or a worse drunkard than him who begat him; and shall it not put any obstacle in the way of a father or a mother becoming unwittingly possessed of the drunkard's appetite, and unwittingly made to bequeath to their offspring the drunkard's entailments?

In view of the alleged, and apparent failure of prohibition, as it has assumed shape in our State constitution, and the former enactments of the Legislature, many persons, who sincerely deplore the great and increasing evils of intemperance, are most strenuously urging that the State should recede from its prohibition grounds and enact a stringent license law.

Indeed such a change in the State constitution has been proposed by the recent Constitutional Commission, and has just been discussed by the Legislature.

Whether it would be submitted again to the people to choose between license and prohibition in the organic law of the State was, for a time, uncertain. That many who strenuously advocate this measure are honest in their effort to inaugurate it, and sincere in their belief that, when inaugurated, it will largely diminish the evils of the whiskey traffic, I have no doubt.

The shrewd and cunning liquor dealers have played their game very deftly until they supposed the question was fairly before the people for approval or rejection. Then they have at once come out with a "Confidential Circular" to the "Liquor Trade," in which all the "40,000 voters in the State who are directly interested in the license question," are urged to come up unitedly to the support of the measure. "The Leader" has been established in the interests of license, and all liquor men are invited to become agents for its circulation.

Subscriptions to the "Leader" can be sent to any of the 130 subscribers to the "Confidential Circular."

Does this movement on the part of liquor men look as if "license" was expected to decrease the sale of their wares? Does it look as though "license" was expected to decrease and "hedge in" the evils growing out of the liquor

traffic, or to "hedge in" the liquor dealers, by the protecting arms of the State?

It may be urged, with truth, perhaps, that a high rate of license will shut up many of the small retail establishments, which by the more pretentious saloons and bar-rooms are called "low doggeries;" but will it decrease the amount or improve the quality of the liquor drank? Where do our young men start to become drunkards?—at the "low doggeries" or at the more pretentious saloons and in the bar-rooms of our first-class hotels?

If the *starting places* for drunkards are not diminished, but on the contrary are amplified by means of license, and made more respectable by the sanction and protection of the State, will such a system reduce the number of drunkards or mitigate the evils of drunkenness? Would not these very saloons, compelled to pay largely for the protection of the State, seek to whelm a greater number of victims into their hellish vortex than if they should remain as to-day, *outlawed* by the State?

Can a State which has stood up so nobly against this diabolic trade for eighteen years now be persuaded to trail her flag to such an enemy?

Far better let the wretched work go on under protest and in spite of prohibition, than to be a yielding and a willing agent to carry it on!

But I am sure that the question is not to-day between "*free rum*" under the prohibition of the State and "*protected rum*" under the license of the State. I am confident that the time is not very distant when the moral sense of the people upon this question, educated and awakened, shall create such a public opinion in every community that the prohibitory enactments shall no longer remain a dead letter; but the people shall arise in their majesty, and the bodies and the souls of the citizens of the State shall be protected and defended, instead of the "hell-fire" that now burns and destroys them.

The woman's movement in this cause is the outgrowth of an enlightened and an awakened conscience that pervades the whole people. It recognizes the power of the enemy; knowing that "this kind goeth not out but by prayer and fasting," it takes hold of an arm stronger than man's and above the State. Every one who loves his fellow men, and rejoices in the downfall of evil, though he might not have inaugurated such a movement, yet, with all his heart, wishes it a God-speed!

Would to God, that, as John the Baptist was a precursor of one that was greater than he, even so this movement may be the precursor of a movement that shall wholly overthrow the demon alcohol, and shall usher in the kingdom of temperance and good will to men!

But this woman's movement must be supplemented by an earnest aggressive movement of society under the prohibitory laws of the State.

What shall that movement be? Given, the following elements of the question, how shall the question be solved? License is prohibited by the State Constitution; the sale of liquor is prohibited by the laws of the State; the sale of intoxicants is carried on to an enormous extent by many hundred citizens; this sale makes inebriates; makes insane; makes paupers; makes idiots; projects these entailments into future generations; makes more criminals than all other causes; levies a vast burden of taxes; brings more want, suffering, and misery upon the people than all other causes.

A question with such pressing and fearful elements must have an answer. If it is decided that the few who sell liquor, and fatten upon the woe, the poverty, and the miseries of others, cannot effectually be hindered from doing it, is it not at least fair that they be required to bear the burdens which they

create? It would certainly seem but simple justice that a special tax be placed upon every liquor dealer in the State, of a certain per cent upon the amount of the sales; for example, 5 per cent on the wholesale sales, and 10 per cent on the retail sales, the amount of sales to be given under oath. This tax should, upon the tax books, as well as upon the tax receipts, be thus divided and named; one portion (to be fixed by law) for the cure and restoration of inebriates; one portion for the cure or care of those made insane, directly, indirectly, or hereditarily, by alcohol; one portion for the care and maintenance of idiots and paupers, made so directly, indirectly, or hereditarily, by alcohol; and one portion for the punishment and cure of criminals, made such, directly, indirectly, or hereditarily, by alcohol.

Such a tax would be based upon a principle that would seem to be eminently fitting and just. Indeed, the State has already recognized the principle in the enactment of the recent dog-law, in accordance with which every keeper of a dog has to pay a tax that goes to pay for sheep that may be killed by dogs throughout the State.

But the keepers of some of the more "respectable" saloons and "bar-rooms of first-class hotels," say, "the whiskey sold by us makes no man an inebriate, insane, idiotic, or a criminal, and we ought not to be taxed as the keepers of these 'low doggeries' are." But the "low doggeries" would answer, "we are the same breed of dogs as you, only that you are better fed than we." "You wound and demoralize the fair and sound sheep, and we feed upon the sheep that you have ruined."

But however just and righteous such a tax law would be, would it meet the whole case? Would it abolish the sale of intoxicants? I think not. For although the sale should be branded and constantly and publicly advertised as a drunkard-insane-idiot-pauper-criminal-producing business, and should thus become vastly unpopular, and none but the abandoned would engage in it, still there would be found plenty of men base enough even then, for filthy lucre's sake, to carry it on, and under such a stigma would try to drag as many to destruction as possible. Chains are the only means that will keep some dogs from killing sheep. But there is one other element to be added to the case, viz.: the fact that *communities or society does now uphold the sale of liquor by its silent acquiescence and its neglect to execute the prohibitory laws*. This element added to those already named, the complete and perfect cure for these dreadful evils seems most naturally to be indicated.

Let the Constitution of the State be changed if necessary, so that the Legislature may pass a law requiring that any township, village, or city, that shall neglect to execute the present prohibitory liquor law, and shall permit the sale of intoxicating drinks within its boundaries, except as may be specified, shall levy upon all its tax-paying inhabitants a tax of a certain per cent of the amount of all the sales of intoxicating drinks within its boundaries, which tax shall be collected as other taxes are, and shall be paid into the treasury of the county, and shall be held sacred, in all its parts, for the purposes specified upon the tax roll and the tax receipts, which purposes shall be as follows, viz.: one portion (to be fixed by law) for the cure and restoration of inebriates; one portion for the cure and care of those made insane, directly, indirectly, or hereditarily, by alcohol; one portion for the care and maintenance of idiots and paupers, made so, directly, indirectly, or hereditarily, by alcohol; and one portion for the punishment and reformation of criminals, made such directly, indirectly, or hereditarily by alcohol.

Is it not quite time for the State to put upon its statute book the fact, by

inference, at least, that intoxicating drinks are chargeable with the great crimes alleged against them?

Such a law would be based upon the principles of justice and equity. Openly charging the great evils that now are pressing down upon society like an incubus, directly to their source, it would do much towards alleviating those evils by providing means for the cure and restoration, or the care and maintenance of their victims. It would lay the cure or care of the victims upon the very people who are responsible for their being victims. It would be like the voice of God telling men that *they are their brother's keepers*.

But, says one, "only those who actually engage in selling intoxicating drinks are responsible for the evils which they do, and they only ought to be taxed for the damage which they cause." The State, conscious of the righteousness of her former laws on this subject, sitting with even balance, answers, "Heretofore I have forbidden the sale of alcoholic drinks among my citizens, because I knew and deprecated the fearful consequences of such sale, and would have shielded all my citizens from them; and yet the sale has been continued, because in many towns, villages, and cities my citizens have not had the moral courage to say the law shall be executed. Besides many citizens, who know full well the effects of whiskey-drinking, because they think that some part of the proceeds of its sale may come to their pockets, have utterly refused to aid or abet the execution of my salutary laws, but have lent the whole moral power of their silence to those who willfully disobey my laws; while others have thought to court political favor and secure some office under my government by giving the whole force of their silent acquiescence to the free sale of whiskey.

"In some places, it is true, my citizens have faithfully executed the laws, and the terrible effects of whiskey-drinking have been largely avoided.

"And yet, heretofore the taxes that have been incurred in consequence of this traffic have been spread upon all my citizens alike, both upon those who spurned my commands, and by their disobedience created those taxes, and those who obeyed my laws; both on those who lent their moral influence to the execution of my laws, and on those who gave the moral power of their silent acquiescence to the breaking of my laws.

"Hereafter, it is my purpose that the consequences of evil doing shall be visited upon those only who disobey, or by the moral power of their silence encourage disobedience, and protect the disobedient.

"It is my purpose also to take those burdens from those who obey and encourage obedience to my laws.

"I can assure all my citizens that in the same degree in which they obey and secure obedience to my laws, will they be relieved of the burdens of these taxes.

"I have taken this way to educate my citizens concerning the great and terrible evils of intemperance, and also concerning the crime of silently acquiescing in the disobedience of others. I want to teach them, too, that although '*millions*' are now held out to tempt them on the side of whiskey and disobedience in its sale, yet the gains of obedience to my salutary laws are not to be computed by even '*millions*.'

"Do the citizens of any town, village or city shrink from bearing the burden of the taxes I have named? They have only to compel obedience to my laws, and the taxes are not levied, for the necessity for those taxes does not exist. There is, also, no township, village or city, within my boundaries, where the intelligent, moral, and Christian citizens could not within three months, if their whole moral power was exerted, compel complete obedience to my laws of prohibition."

Gentlemen, for the education of the people of this State upon all matters touching this subject, so that the enactment and execution of such a law may be possible, carrying with it the execution of the present prohibitory laws of the State, and thus saving the State, both in the present and future generations, from the terrible entailments of alcohol, it must be ours to labor.

We need more exact and complete statistics on all branches of this subject.

What percentage of the people of the State do actually drink alcoholic liquors?

How many persons in the State do actually die annually, directly or indirectly, from the effects of alcoholic drinks?

Our present system of collecting the vital statistics is but the sheerest mockery as it regards this matter, when every sort of disease is given to cover up deaths from alcoholism.

We greatly need reliable statistics concerning the hereditament of physical and mental degeneracy from the effects of alcohol, and concerning the hereditary predisposition to crime and vice from the same cause. These can be secured only, or at least the best, in our insane asylums and asylums for other defectives, our alms-houses, reform schools, jails, houses of correction and State prison.

Would it not be well if this Board were placed in charge of these statistics, and authorized to design blank tables for each of the above named institutions, whereby their officers might further our efforts to secure such statistics?

We need, too, to secure the exact or approximately exact figures as to the percentage of crime fairly attributable to alcohol, and the cost to the State of its detection and punishment. These statistics might be gathered by all criminal courts upon blanks to be designated by this Board, and would be of the utmost importance in the education of the people upon this subject. The statistics gathered annually by this Board, or by the officer who shall have them in charge, should be published and thoroughly circulated so as to reach every citizen of the State.

But so much cannot be hoped of the present generation of adults as of those who are now children in our public schools.

As the children are the great hope of the State, one of the greatest *desiderata* of our times is a manual of health for our public schools that shall not only embrace all the general principles of hygiene, but shall be especially full, clear, and distinct in its teachings, enforced by reliable statistics in respect to the influence upon the body and mind of the habitual or free use of the narcotic or narcotico-acrid stimulants.

It would give me great pleasure if such a book were now at hand which this Board might recommend for adoption into our public schools.

Should some philanthropist awake to the welfare of the coming generations or should the Legislature, at the suggestion of the Governor, offer a worthy prize for the production of the best work of this sort, covering the grounds I have named, I have no doubt that we should very soon be able to recommend for adoption into our public schools, a book every way in advance of any school physiology now extant, and a book that would accomplish very great good in staying the terrible evils of intemperance.

I desire to acknowledge my indebtedness for very many of the facts and statistics in this paper to the following authors, viz.: Dr. Wm. B. Carpenter, F. R. S.; Dr. Henry Munroe, F. L. S.; Dr. W. Marcet, F. R. S.; Dr. F. R. Lees, F. S. A.; Frederick Powell, Dr. John Bell, and Dr. Chas. A. Story.

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**REPORT**  
ON A  
**SPECIAL INVESTIGATION**  
CONCERNING  
**IMPURITIES <sup>and</sup> ADULTERATIONS IN TABLE SYRUPS.**

BY  
**R. C. KEDZIE, M. D.,**  
**Member of the Board.**

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## TABLE SYRUPS.

BY R. C. KEDZIE.

Many weeks ago a can of syrup was placed in my hands by Prof. Beal, which had the following history: A family by the name of Doty, of Hudson, Mich., purchased some syrup of a grocer in that village. The members of the family ate freely of the syrup, and were all made very sick by its use. They became alarmed and sent a can of the syrup to the Agricultural College for analysis, supposing it to contain poison. Other families in the vicinity became so alarmed by the singular sickness in the Doty family that they returned their syrup to the grocer. The grocer had purchased the syrup from a very respectable wholesale dealer in Toledo, Ohio, who claimed to have bought it from the manufacturer for pure cane syrup.

The syrup was of a light yellowish-brown color, and looked like a very respectable syrup. It had a decidedly acid reaction with blue litmus paper, turned black when sulphide of ammonium was added to it, and gave a heavy precipitate with oxalate of ammonia. On analysis I found that the body of the syrup was made of starch sugar (glucose) instead of cane sugar. The amount of foreign impurities will be given in the results of examination, being No. 9 in that series. The free sulphuric acid (oil of vitriol), the sulphate of iron (copperas) and sulpho-saccharate of lime were probably the cause of the sickness in the Doty family.

The results of the analysis of this syrup induced me to examine a number of table syrups to ascertain whether similar adulterations exist in other varieties of table syrups.

Dr. Letheby in his admirable work "On Food," states that the Anglo-Saxon population of England and America consume annually 41.4 pounds of sugar per head; the Latin race, including the inhabitants of France, Italy, Spain, Belgium, Portugal and Switzerland consume 12.34 pounds per head; the Teutonic race of the Zollverein, Austria, Holland, and Denmark consume 7.3 pounds per head; while the poor of Russia, Poland, Turkey and Greece consume only 3.3 pounds per head.\*

The Anglo-Saxons are pre-eminently a sugar-consuming race. There are

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\* Letheby on Food, p. 80.



few luxuries so prized by Americans, for whom the chief articles of table luxury have sugar as an important element. This large consumption of sugar is not confined to the wealthy, but is almost equally as common with those of limited means. To defraud the poor man of his sweet, is to cheat him out of the chief table comfort which his poverty can afford.

Before giving the results of my examination of table syrups, I will remind my readers of certain facts regarding sugar. There is a large class of substances included in the general term, *sugar*. Only two are of sufficient commercial importance to demand our attention at present. One is termed by the chemist *sucrose*, and includes cane sugar, beet sugar, and maple sugar. These sugars are chemically identical, and possess the same amount of sweetening power. Sucrose exists in the sap of a great variety of plants, and has never been manufactured from any other material.

The second class is called *glucose* or grape sugar; the white lumps of sugar in raisins are glucose. This kind of sugar may be manufactured from other materials, *e. g.*: from starch, woody fibre, etc. While it is possible to make this kind of sugar out of old cotton and linen rags, paper, sawdust, etc., yet it is not profitable to do so, because of the time required to make the change and the difficulty in purifying and decolorizing the sugar when it is made. But this sugar can be very rapidly and economically made out of starch, and the manufacture has been carried on in France for a long time, and seems to have been introduced into this country.

The chemical composition of cane sugar differs from that of starch only by one molecule of water, while grape sugar differs from starch by two molecules of water. If we could chemically combine one molecule of water with one of starch, we could make cane sugar. Chemists have attempted this by boiling starch with dilute sulphuric acid, but they always overdo the matter, adding two molecules of water, thereby getting grape sugar instead of cane sugar. If chemistry shall ever enable us to readily and cheaply combine the one molecule of water with starch, then the millennium of the sugar lovers will have come, for a bushel of corn will then make about 25 pounds of cane sugar.

But chemists have not yet solved this problem which taxes their ingenuity only to tantalize their endeavor.

But while chemists have been baffled in their attempts to convert starch into cane sugar, they have found it very easy to convert starch into grape sugar. I will briefly describe the process as given by Payen, because we shall then more fully comprehend the results reached in the examination of certain syrups. The saccharification of the starch in France is carried on in large wooden vats, capable of holding 2800 gallons. The contents of the vat may be heated by forcing in steam through a coiled steam pipe at the bottom. The steam pipe is perforated to permit the steam to escape at many points into the contents of the vat. In France the steam pipe is made of lead; in this country I suspect they use iron pipes. When two tons of starch are to be converted into sugar, 32 barrels of water and about 80 lbs. of sulphuric acid are placed in the vat, and the whole heated to 212° by forcing in steam. Two hundred pounds of starch are then mixed with 22 gallons of water and stirred up, and 4 or 5 gallons of this mixture are run into the vat. The temperature is kept up to the boiling point all the while, and successive charges of starch are run in till the whole amount is converted into sugar. The steam is then shut off, and chalk is added in sufficient quantity to neutralize the sulphuric acid, but if too little chalk is used, free sulphuric acid will be left in the contents of the

vat. The sparingly soluble sulphate of lime is formed, and much of it settles to the bottom of the liquid; the clear liquid is drawn off and evaporated by steam heat till the proper density of syrup is secured, or until it will crystallize on cooling and standing for several days, according as they seek to make syrup or sugar.

This brief description will assist us to understand why certain impurities are found in these starch-sugar syrups. If iron pipes are used to convey the steam for heating the contents of the vat, the sulphuric acid will attack and dissolve some of the iron, and thus sulphate of iron (copperas) will appear in the syrup. If too little chalk is used, free sulphuric acid will remain in the syrup. The chalk being carbonate of lime, its use will explain why lime may be found in large quantity in the syrup. As chalk is insoluble in water, and sulphate of lime is very sparingly soluble, many persons would suppose that little or no lime would remain in these syrups. But we must bear in mind that sugar itself acts the part of an acid with many basic substances. Thus there are two well known salts formed by combination of sugar and lime, one containing one equivalent of lime to one of sugar; the other containing three equivalents of lime to one of sugar. These sucrales of lime have lost entirely the sweet taste characteristic of sugar, and have a bitterish taste instead. Last spring some students at this College brought me a small quantity of a whitish granular mass which deposited from the maple syrup in "settling" to make maple sugar. The sugar boilers call it *sand*, as it is hard and gritty, insoluble in water, and destitute of any sweet taste. On analysis I found the material to be nearly pure sucrales of lime, containing in addition a small amount of phosphate of magnesia. Here was the natural formation of the sucrales of lime from the elements of plant food contained in the sap.

Not only will sugar thus combine with lime, oxide of lead, oxide of iron, etc., but it will associate with itself sulphuric acid, and form a compound acid which comports itself very differently from simple sulphuric acid. This sucro-sulphuric acid forms a pretty large class of salts which are soluble in water, but especially soluble in solutions of sugar. Reagents which will readily precipitate sulphuric acid and sulphates, *e.g.* chloride of barium, will not precipitate the sucro-sulphates.

Glucose has the same power as an acid substance as sucrose, forming a class of soluble glucosates. It will also associate with itself sulphuric acid, and form a class of gluco-sulphates of a like character as the sucro-sulphates. Undoubtedly a large part of the lime found in these starch-sugar syrups exists in the form of gluco-sulphate of lime. The sparing solubility of sulphate of lime in water is no guarantee that these syrups will not contain a large amount, because it may exist in the form of the soluble gluco-sulphate of lime.

One evil connected with the presence of lime in syrups is the destruction of a portion of the sweetening power of the syrup. One part of lime will destroy more than six times its weight of sugar, so far as any sweetness is concerned; and the compound of lime and sugar is bitter.

In making my selections for examination, I obtained specimens only from those who are regarded as first-class tradesmen. If syrups bought at such places are adulterated, we may well suppose that the inferior class of dealers will have no better articles. Some have said that, undoubtedly, poor people who trade at small groceries are swindled in these syrups, but that the respectable class of citizens who patronize first-class grocers need not apprehend any such imposition. I determined to follow up "the respectable citizen" and see

what syrups he obtained of "first-class grocers." Part of the specimens were obtained near home, but the most from abroad. I have examined 17 specimens in all, with the general result that 2 were made of cane sugar and 15 of starch sugar or glucose.

#### SPECIFIC RESULTS OF EXAMINATION OF TABLE SYRUPS.

- No. 1.—Pure cane sugar syrup.
- No. 2.—Starch sugar syrup. Contains some sulphate of iron (copperas), and contains in each gallon 107.35 grains of lime.
- No. 3.—The grocer called it "poor stuff." I have seldom seen an article that better sustained its recommendation. Made of starch sugar; contains plenty of copperas and 297 grains of lime in a gallon.
- No. 4.—Nearly pure cane sugar syrup.
- No. 5.—Starch sugar syrup. Contains copperas, and 100 grains of lime in a gallon.
- Nos. 6, 7, 8.—All made of starch sugar. Contain sulphate of iron and plenty of lime.
- No. 9.—This is the specimen from Hudson which caused the sickness in the Doty family. A starch sugar syrup; contains in the gallon 71.83 grains of free sulphuric acid, 28 grains of sulphate of iron, and 363 grains of lime.
- No. 10.—Contains starch sugar, copperas, and lime—amount not estimated.
- No. 11.—A starch sugar syrup. Contains in the gallon 141.9 grains free sulphuric acid, 25 grains sulphate of iron, and 724.83 grains of lime.
- No. 12.—Contains starch sugar, seasoned with sulphate of iron and lime.
- No. 13.—Starch sugar. Contains in the gallon 58.48 grains of sulphate of iron, 83.14 grains of free sulphuric acid, and 440.12 grains of lime.
- No. 14.—Starch sugar. Contains in a gallon 80 grains of free sulphuric acid, 38 grains of iron and 262.48 grains of lime.
- Nos. 15, 16.—Contain starch sugar, sulphate of iron, and lime.
- No. 17.—Starch sugar, sulphate of iron, and 202.33 grains of lime.

A very important element in this discussion is the great disparity in sweetening power between cane sugar and starch sugar or glucose. One pound of cane sugar has the same sweetening power as two and a half pounds of glucose. In these starch-sugar syrups, the public is not only treated with compounds loaded with foreign and injurious materials, but they are enormously cheated in the very thing they seek to buy, viz.: the sweetness. Sugars and syrups are bought, not as articles of food solely, but entirely for *their sweetness*, and thus the buyer is largely defrauded out of the very thing for which alone he makes a purchase.

The thought of using such mixtures as a relish for our food is not very appetizing. Some of these drips seem to be made up of about equal parts of fraud and dirt! A facetious friend has quoted, in this connection, the old saying, "A man must eat his peck of dirt before he dies." If any one feels uneasy lest he be defrauded of "his peck of dirt," let him eat a few gallons of No. 11, and he may rest on his laurels for the balance of his days.

#### WHOSE FAULT?

The public will naturally ask, "Who is to blame that such disgusting and fraudulent mixtures are sold in the shops?" I do not think that the retail dealers are "sinners above all that dwell in" Michigan in this respect. Most of them honestly suppose that they are selling a good article of cane sugar

syrup, and are themselves surprised that so good-looking syrups can be sold at so low a price compared with that of sugar—a price often less than that of the dark colored and strong flavored molasses which remains from the manufacture of cane sugar. The manufacturers are chiefly to blame in this matter, for they cannot be ignorant of the fraud in selling glucose for cane sugar; but even they will probably be surprised to learn how large a quantity of foreign materials is left in these syrups.

#### TESTS.

It is popularly supposed that an infusion of tea-leaves will certainly detect the presence of starch sugar, by the dark coloration which it imparts to the syrup. Strong tea will give a re-action of this kind with a salt of iron—the same re-action which makes black ink; hence strong tea may be used to detect the presence of copperas in syrup; but it will give no re-action with grape sugar containing no iron.

In most of these syrups, lime is the largest adulterant aside from the starch sugar itself. Lime may easily be recognized in the syrup by a solution of oxalic acid. Dissolve one ounce of oxalic acid in a pint of rain water; if the solution is not clear, let it stand for a few hours till it settles, then pour off the clear solution into a clean bottle and label it OXALIC ACID: POISON. To test the syrup, place a tablespoonful in a tumbler half full of rain-water, stir it up, and add a tablespoonful of the oxalic acid solution. If there is much lime in the syrup it will show itself by a white precipitate, the amount of which will give some measure of the amount of lime present.

AGRICULTURAL COLLEGE, }  
Lansing, June 30, 1874. }



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DRAINING FOR HEALTH.

BY

HENRY F. LYSTER, M. D.,

Of Detroit, Member of the State Board of Health.

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## DRAINING FOR HEALTH.

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Topographically, geologically, and meteorologically considered, the upper and lower peninsulas of this State are so opposite that they must be studied separately, and we will for the present confine our attention to the lower.

This portion of Michigan presents in the respects just mentioned several features peculiar to it, and not shared in common with the rest of the north-west.

In regard to its topography, it is surrounded on all sides except its southern boundary, by the great lakes of fresh water, toward which there is a gentle declination of the land from the central portion of the State, and down which flow the rivers or natural drainage channels for surplus water. The elevation of Lake Erie above the sea level is 565 feet, that of Lake Michigan is 578 feet; Toledo, Ohio, which lies 10 miles south of the southeast boundary of the State is 604 feet elevation above the sea; Adrian, 1240 feet; Hillsdale, 1086; Coldwater, 965; New Buffalo, 661; Lake St. Clair, 570; Detroit, 597; Ypsilanti, 535; Ann Arbor, 891; Marshall, 889; Decatur, 770; Lake Huron, 578; Bay City, 650; Owosso, 732; St. Johns, 755; Muir, 647; Grand Rapids, 780; Grand Haven, 588. It will be seen from the elevation of these cities and towns that the central portion of the State is sufficiently raised for all the purposes of a water shed. There are surveys of hills and summits which are somewhat higher than most of the towns noted, which will be referred to as we proceed.

Prof. A. Winchell, in his sketches of Michigan, gives the following description: "Proceeding from the littoral belt of the peninsula toward the interior, we find a region considerably more elevated and better drained than ancient official misrepresentations had led the general public to believe. Though presenting no mountainous districts, and no indications of the agency of forces of upheaval, we have a land area attaining throughout a large portion of the peninsula an elevation averaging from 400 to 1000 feet.

Erosions dating back into geological time have pared down the original surface, and established the existing shapes to the lake shores, and even to the lake bottoms. Later fluviatile erosions have scored deep broad valleys which mark off the prominent portion into several distinct regions.

Viewing the peninsula as a whole, we discover a remarkable depression stretching obliquely across from the head of Saginaw Bay up the valley of the Saginaw and Bad Rivers, and down the Maple and Grand Rivers to Lake Michigan. This depression attains nowhere an elevation greater than 72 feet above Lake Michigan, and this is chiefly in the interval of three miles separating the waters flowing in opposite directions. This spot was chosen in 1837 as the location for a canal connecting Saginaw Bay and Lake Michigan.



That portion of the peninsula which lies to the southeast of this dividing depression has a water shed stretching somewhat arcuately from the northeast to the southwest, through Huron, Sanilac, Lapeer, Oakland, Washtenaw, and Hillsdale counties, which is not broken through by any stream. From the summit of this range of elevated land, which contains a number of spurs or hills, arise the streams which uniting form themselves into rivers emptying into the lakes upon the eastern shore, or into Lake Michigan upon the west.

A similar summit divides that portion of the peninsula lying north of the depression between Saginaw Bay and Lake Michigan, and this range exemplifies, like the southern one described, a strong tendency to a northeast and southwest disposition, separating the Muskegon (the longest river in the State) and the Pine and Little Traverse rivers, flowing southwest from the Thunder Bay and Sable rivers, flowing into Lake Huron. The elevated land in the upper portion of the peninsula is the highest in the State south of Mackinaw, Houghton Lake being at an elevation of 589 feet above Lake Michigan, and several positions in this elevated watershed possessing an elevation from 700 feet to 800 feet, and one point in Otsego county is said to attain an elevation of 1200 feet. The enumeration of eighteen summits in these divides, in the whole peninsula, must not be allowed to produce the impression of any very marked irregularities of surface. The summit districts are not generally mere hill tops, but are level and gently undulating plateaux through which atmospheric and fluviate erosions have excavated drainage valleys of moderate depth, or with gently bounding slopes. There are consequently few precipitous hillsides and but very limited regions which cannot be subjected readily to the operations of agriculture. Besides the great lakes lying upon its frontiers, the State includes within its boundaries 5173 smaller lakes having an area of 712,864 acres.

Geologically considered, the lower peninsular is the central part of a great synclinal basin, towards which the strata dip from all directions. \* \* \* The outcropping edges of strata older and older in the series are passed over in traveling from the centre of the peninsula outward. The whole series of strata may be compared to a nest of wooden dishes. \* \* \* In concluding this synoptical sketch of the topographical features of Michigan, it remains to direct attention to one interesting generalization which has not heretofore been pointed out. This is what may be called the diagonal system in the physical features of the State, that is, the longitudinal axes of the topographical and hydrographical features of this State, especially of the lower peninsula, lie in directions which are diagonal to the cardinal points of the compass. The diagonal system in American physiography is not by any means confined to Michigan. It would be easy to show that these features sustain relations to the underlying rocky structure, also to demonstrate that they are closely connected with the movements of the continental glacier, which geologists believe to have moved in the lake region from the northeast to the southwest during the epoch immediately preceding the advent of man upon the earth. But at the same time it would appear that these features do not conform exclusively to either set of agencies; and their relation to each other may be expressed in the following proposition: The actual topographical and hydrographical axes of Michigan and the whole lake region are the resultant of two forces,—a glacial acting from the northeast, and a stratigraphical acting along the lines of the rocky formations.

Meteorologically the effect of the presence of the great lakes is noticeable in

the marked deflection of isothermal lines, the lessened precipitation of moisture, and the lengthened growing season, and exemption from unseasonable frosts. \* \* \* The sinuosities of the several lines will demonstrate at a glance the peculiar character of the climate of Michigan, and the fact that both in summer and winter it is better adapted to the interests of agriculture and horticulture, and probably also the health of its citizens, than the climate of any other Northwestern State. The mean annual precipitation of the whole State is 31 inches,—upper 30, lower 32. This is about the average for Wisconsin, Minnesota, Iowa, Nebraska, and Kansas. The States southeast of Michigan show a precipitation of 40 to 44 inches.” We have drawn upon Prof. Winchell’s Sketches of Michigan quite freely, for the reason that there is no other authority so reliable in regard to the topography of the State, and to bring prominently forward the physical condition of the State.

We may mention here as a historical fact, that a commission whom the Federal government had ordered to report at the close of the first quarter of the present century, upon the feasibility of locating in this territory soldier bounty lands, reported that there were not 500 acres of good arable land in the interior of the whole State; and in consequence of this unjust report emigration was directed to other channels.

We have seen from the reports already made that Michigan, instead of being a marsh, is a rolling country, rising gradually to quite an elevated centre, sufficient to permit free natural drainage, and allowing the use of artificial drainage throughout the whole extent of its widely separated boundaries.

#### DRAINING FOR HEALTH.

The drainage of land for the purpose of putting the soil in the most favorable condition to meet the vicissitudes of seasons, and to produce with certainty the crops of cereals, staple vegetables and grasses has been conducted from time coeval with the introduction of man upon the earth in his primeval occupation, farming.

For the purposes of improving and preserving the health of towns and cities, the subject of drainage and sewerage has to a greater or lesser degree attracted the attention of dwellers in those communities, particularly that of the public officers and those invested with the authority and responsibility of the health of the people.

There can be no doubt but that in many of the cities of olden times systems of sewerage, and also drainage of the adjacent lands, were effectively employed; certainly in that great centre of ancient civilization, Rome, the *Ædiles* redeemed from the surrounding pestilential marshes the great city, by a vast and complete system of covered sewers, and also brought into the city the fresh water from many miles distant in great aqueducts, the ruins of which are to-day among the most notable relics of their ancient civilization, which not only supplied the city with water, but washed from it into the yellow Tiber all of its sewage.

Pompeii to-day partially disrobed of its ashy pall, lies a silent testifier of the wisdom and experience in this respect of the city fathers of the first century.

It is strange, that notwithstanding the acknowledged importance of this subject, and the length of time it has been studied, and frequently at times and in certain districts understood and appreciated, there is no large work or a standard authority in the literature of Hygiene that affords the information

on these matters to any one who desires to thoroughly investigate this subject in its relation to health, or the longevity of the race. Neither is there any extensive series of papers which may be consulted.

The evidence as regards the value of drainage both for health and for wealth is scattered through the records of sanitary government and improved agriculture, from the time of the Romans down to the latest report of the medical officers of the Privy Council and the Registrar General of Great Britain. There are papers to be found now in an agricultural report of the Government, or some government, and again in a newspaper or a popular journal; they may be in the annual report of British Social Scientific Association, or in a monograph by some enterprising civil engineers. Among the latter, to which we will have frequent occasion to refer, we notice the satisfactory works of Col. Waring's *Drainage for Profit and Health*, 1867, and J. H. Klippart, *Principles and Practice of Land Drainage*, 1861. "To illustrate the importance of the subject of drainage, and to show that all facts bearing directly or indirectly upon it should enlist our deepest interest, we will notice here the fact that in a recent report of the Privy Council medical officer and the Registrar General's records show that in England and Scotland the life of the people gains from 20 to 25 per cent. in years, and suffer less than half the average sickness and disability in the well drained districts. Dr. Wm. Farr's essay on *Vital Statistics and new Life Tables*, based upon 63 of the healthy districts of England, in which the mathematical demonstration is complete, and upon the same grounds the districts themselves give the names of the best breeds of horses, cattle, sheep, and fowls in the Kingdom. Industry and the army, says Dr. Farr, receive their best recruits from this population, while they get their worst from the low parts of sickly towns."\*

Previous to considering the various forms of disease which are induced or increased and aggravated among the people by defective drainage, let us examine into what kinds of soil need drainage for health, and what are the appearances presented by it in itself and in the vegetation which grows upon it. The tenet or proposition that land which requires drainage to render it capable of its best production, under all the changes of the different seasons, requires it for the purposes of rendering it healthful, is not as paradoxical as might at first appear to one not reflecting upon its full bearing. We believe, without insisting upon its absolute verity in all cases, that it may be taken as an axiom, that wherever drainage of farm lands is found profitable in a pecuniary point of view in the increase and reliability of crops, it will be found advantageous as a hygienic measure to all animal life dwelling upon them. If this is the fact, the farmer whose only idea in draining is with reference to increasing by proper drainage the products of his acres, is placing upon a surer foundation his own health and strength and that of his family and live stock; and as he enlarges his granaries to receive the increase of the harvest, he is laying by a store of health and strength to draw upon, not only in the winter of his days, but during the whole period of his existence.

Land requires drainage in all cases when the subsoil is not itself pervious, and therefore permeable by the water which falls upon it or runs into it.

It makes no difference what the quality of the soil may be, it may be clay, or sandy loam, or gravelly loam, yet if the subsoil is not easily penetrated by water it should be drained in some manner.

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\* Letter from Elisha Harris, N. Y., Registrar Vital Statistics.

The surface indications are very various. In some cases the water may be seen standing upon it a considerable period after a rain, or it may show itself in the furrow after plowing, or the land may look dark and wet long after the neighboring fields have resumed their light-brown or yellowish hue. Low places, swamps, familiarly known as cat-holes, springy places at the side and foot of hills rendering the land for rods wet and cold, sandy and pervious soils with clayey subsoils and impervious soils need drains. "All lands," says Klippart, "whose indigenous growth of timber was beech, maple, ash, elm, or any other kinds of timber, or shrubs requiring wet soil, is seldom tillable, and never profitably so until it is underdrained. By digging, during the spring and earlier summer, trial pits here and there over the farm three or four feet deep, the question as to the necessity of drainage may be determined; this may also be done in the wet season by thrusting down or driving down a small stake the same depth and observing whether, upon removal and sounding, water is found to remain at the bottom. If water remains in these holes the land is saturated and needs depletion by means of drains. Klippart has translated from Burral's work on draining (French), a number of indications presented by land needing drainage as follows: "Wherever after a rain water stays in the furrows; wherever stiff and plastic earth adheres to the shoes; wherever the foot of either man or horse makes cavities that retain water like so many little cisterns; wherever cattle are unable to penetrate without sinking into a kind of mud; wherever the sun forms on the earth a hard crust, slightly cracked, and compressing the roots of plants as into a vise; wherever three or four days after rain slight depressions in the ground show more moisture than in other parts; wherever a stick forced into the ground a foot and a half deep forms a hole like a little well, having water standing at the bottom; wherever tradition consecrated as advantageous the cultivation of lands by means of convex, high, large ridges; one may affirm that drainage will produce good effect.

When water stands on the surface after rain or when it oozes from the inside from below, as the farmers say, there is no doubt that drainage will be the best improvement that can be made. In all the above cases vegetation cannot easily take place; crops are scanty and often amount to nothing; the species of plants which find that kind of land hospitable signalize them spontaneously to the eyes of the observing visitor; these parasitical plants are in possession of wet land, and often expel therefrom productive vegetation; weeding is of no avail; drainage only can effect the cure and restore wholesomeness to the ground and life to the crops.

The want of drainage is well shown by stunted and weakly condition of the crop which may be upon it, either in a dry or wet season; by its hard and cracked surface in dry weather, and by its sodden, cold, sour condition in rainy seasons; by freezing out the wheat in winter, and by lodging it in summer, from the rank growth of straw in wet seasons, particularly in sheltered places overshadowed by trees; by the unevenness of the crops in the same field; by its fogs settling upon it or rising from it."

In many of the foreign works are given lists of weeds and plants and trees that are to be found in ground too wet for profitable farming, but these lists are applicable largely to the country in which they are compiled, only a limited number being so widely diffused as to be largely represented in this country. We will give, however, a list which will be found to be very well adapted to this latitude and longitude, taken from Klippart's Principles and Practice of Land Draining: "Water plantain (spearwort) cursed crowfoot, bristly crow-

foot, marsh marigold, water-cress, marsh-cress, cockoo flower, pale touch-me-not, spotted touch-me-not, false mermaid, poison sumac (dogwood), Canadian burnet avens, water or purple avens, swamp rose, deer grass, loosestrife, willow herb, water purslane, ditch stone-crop, swamp saxifrage, cowparsnip, cowbane, water hemlock, hemlock, poison hemlock, silky cornel, red osier dogwood, stiff cornel, button brush, golden-rod, sunflower, tick-seed sunflower, burr marigold, sneeze-weed, tuberous Indian plantain, swamp thistle, cardinal flower, giant lobelia, rib grass, snakehead, monkey-flower, water speedwell, brooklime, marsh speedwell, lousewort, water willow, fog fruit, false dragonhead, skullcap, forget-me-not, knotweed, swamp dock, green dock, swamp oak, water oak, skunk-cabbage, sweet-flag (calamus), cat's-tail flag, arrowgrass, arrowhead, great purple orchis, ladies' tresses, ladies' slipper, blue flag, blue-eyed grass, squill (white hyacinth), club rush, wool grass, wild yellow lilly, cotton grass, white grass, false hellebore, wild water foxtail, woodrush grass, bog rush, blue-joint grass, fresh water cord grass, gelingah manna grass, reed meadow soft grass, vanilla, reed canary grass, millet grass, Indian grass. So soon as the soil is properly underdrained all the plants named in the above list will disappear, because their accustomed supply of moisture will then be withdrawn, and they will of course perish."

The objections to too much water in the soil are these: the soil is not in a proper condition to permit the healthful and normal growth of the crops and grasses sowed or planted in it, the temperature is too cold in the spring and fall and even in the midsummer, thus shortening materially the season and affecting the humidity and temperature of the air upon its area. It prevents somewhat and at least diminishes the proper fertilization of the soil by the new rains. In the report of the Massachusetts Board of Agriculture, 1868-9, Mr. Brown remarks upon the effects of drainage, "it makes cold land warmer, wet land dryer, dry land wetter, heavy land lighter, light land more compact," in some cases; and that land thoroughly drained, if it is anything like hard land, can be cultivated at about one-half the cost of wet land. He believed that all lands have inherent powers of self-recuperation. If land is skimmed over with a crust, it may remain so for a hundred years and not become fertile, but remove that crust and get it into a fine tilled surface and it will improve from year to year; vegetation will spring up and grow luxuriantly. One of the effects of drainage is to give land a chance to do something for itself. Heat will help it much without ploughing, manuring, or seeding. He knew a meadow that had been covered with hassocks from three to ten inches high; a drain was run through the entire length; one side was drained with lateral drains twenty feet apart and four feet deep. In two or three years, without the use of a plough, manure, or seed, every hassock disappeared from the half so drained; the ground became smooth and beautiful, and timothy came up three or four feet high and some of the heads measured nine inches in length; while on the other side where no lateral drains were made the hassocks remain to this day."

Col. Waring, in his *Hand-Book of Husbandry*, 1870, claims that the following advantages will result from a thorough system of tile draining: 1st. It greatly lessens the evil effects of drought. 2d. It enables the soil to receive a larger supply of the fertilizing gases of the atmosphere (carbonic acid and ammonia). 3d. It warms the lower portions of the soil. 4th. It lessens the cooling of the soil by evaporation. 5th. It greatly facilitates the chemical action by which the constituents of the soil are prepared for the

use of plants, and by which its mechanical texture is improved. 6th. It tends to prevent grass lands from "running out." 7th. It deepens the surface soil. 8th. It renders soils earlier in the spring, and keeps off the effects of cold weather longer in the fall. 9th. It prevents the throwing out of grain in winter. 10th. It enables us to work much sooner after rains. 11th. It prevents land from becoming sour. 12th. It lessens the formation of a crust on the surface of the soil after rains in hot weather.

In a saturated soil the water which remains has already given to it all the material it has had to impart in the way of nourishment, the ammonia, carbonic acid, nitric acid, and heat severed from the air, also all the animal and vegetable fertilizing material which it may have found upon the surface as it penetrated downward to the subsoil, and it has no further work to perform, save to supply the moisture which the capillary attraction of the fine particles of soil has the ability to retain, which is amply sufficient to keep mellow the soil. By examining with a glass the finer particles of soil, it will be found that there are spaces between them, and also microscopic pores in each particle of earthy matter.

In properly drained land these interspaces are filled with air, and the pores are full of water, so that the elements best fitted and proportioned for the life and growth of the seed or rootlet are present, viz: air, heat, and moisture.

Light is not directly necessary, and the covering of the seed by the top dressing of earth or mold in planting or sowing excludes this.

The quantity of moisture held in thoroughly drained land by its absorptive qualities is very great, and is estimated at one-half of its bulk in some cases. As the quantity and extension of the finer pores vary greatly in different soils, so the water they are capable of containing through capillary absorption is very different. The most compact soil, represented by clayey soil, retains the most, and the coarser soils, as sand, sandy gravel, etc., the least.

By the introduction of effective drains the water table, or point of saturation, is lowered to a sufficient depth to allow of the absorption of a large part of the water falling upon the surface of the ground and, as we remarked, affording the proper receptacle for the crops and herbage which will penetrate below the influences of the prolonged drouths or to be influenced unfavorably by the long-continued rains of unseasonably wet periods.

A saturated soil is colder than a well drained one, and in this lies an important element of its unhealthfulness. The lowering of the temperature is brought about by several methods tending to produce the same condition in different ways. In the first place, the water already occupying the soil and saturating it has parted with a large part of the heat with which it was laden when falling as rain upon it. Its presence prevents the warm rains, which subsequently fall, from entering, and they are obliged to run off from the surface and carry away with them their own heat and that received from the crust of the soil, or the surface exposed to the sun's rays, besides the valuable gases and fertilizing products which they hold in solution. The very constant and increased evaporation from undrained land (and this is in reality the most important method of all in its power to diminish the temperature), has long since been recognized. Dr. Madden, quoted by the General Board of Health on this point, says, "I find by careful experiment in summer this reduction to be 6.50°F., which is equivalent to an elevation above the sea level of 1,950 feet."

Water does not serve as a good conductor of heat, and the heat falling upon

always in the end a public good, and that the general or average public health is much better for it."

Dr. Brownell, of Utica, Macomb county, under date of February 28, 1874, writes:

"Malarial fevers are diminished in a marked degree by drainage. One marsh known as the Harrington creek marsh, one mile wide and four to five miles long, was drained in 1871. Previous to that date hardly a season passed but what those living on the borders and in the vicinity were prostrated with malarial disease in some form. Since that time they have been comparatively free from sickness. The drain was opened about the middle of August, and although there were many sick with fever and ague in that vicinity at the time, the number of cases diminished instead of increasing, as had been the case formerly at this season of the year, so much so as to be a subject of common remark among those who were familiar with the facts. Such cases as did occur yielded more readily to treatment and were less liable to recur.

"Malarial diseases here have been gradually diminishing. I have seen the time when full 75 per cent. of all sickness had its origin in malaria. This change is due, in my judgment, in no small degree, to the artificial drainage which has been carried out in this portion of the State. I am fully convinced from the experience and observation obtained during twenty-two years' practice in the profession of medicine, in a locality where artificial drainage was and is yet largely necessary in order that the land should be fit for agricultural purposes, that the authorities and people have been and will be amply repaid for all the trouble and expense in the work of drainage, by the good that has grown and will continue to grow out of it to the public health alone."

## DRAINING FOR HEALTH.

[NOTE.—When the foregoing was printed, it was supposed that the entire report on "Draining for Health" was included. But after this "form" was printed, the closing part of the article has been received from the author, and in order that it may appear in its proper place, it is inserted, without paging, between pages 52 and 53.—H. B. B., Secretary of State Board of Health.]

Numerous other causes exist besides defective drainage to account for the existence of the diseases previously mentioned. Indeed in some of them the matter of drainage has not been definitely considered.

It has been observed in connection with the prevalence of cerebro-spinal meningitis, that it, in many cases, prevailed rather in the undrained portions of the locality where it occurred, than in the higher and more salubrious portions; yet it can not be affirmed that it depends for its origin or for the intensity of its effects upon the quality or condition of the soil. This, however, has been noted, that a large plurality of cases have occurred in damp and deficiently drained regions.

Dysentery is more generally met with in countries where malarious fevers prevail than in localities where they do not appear. This disease not unfrequently precedes, or is followed by intermittent fevers, and usually prevails at the same seasons of the year in which malarious fevers are prevalent. There is no disease, with the exception of malarious fevers, which is more generally or completely eradicated by drainage than dysentery; although in this, as in many other diseases, other causes may operate with sufficient power to determine it, notwithstanding the removal of one of the most fertile sources of its endemic origin, as, for instance, impure water, or inappropriate or spoiled food.

The almost complete removal of this very dangerous disease from the city of Detroit has been noticed within the past ten years. In former years it prevailed in Detroit in common with malarious fevers; but with the general introduction of pure lake water and the general extension of the sewerage system throughout the limits of the corporation, it is but rarely met with, and never in any endemic form.

In this connection, I may be allowed to state that there have been built from 1835 to date (Nov. 1874), very nearly if not quite one hundred miles of public sewers.\*

The water supply reaches throughout the whole limit of the corporation and extends into Springwells and Hamtramck on either side.

All forms of malarious diseases have decreased in Detroit within the last twenty years, fully seventy-five per cent. per capita.

Typhoid Fever, or the "Enteric Fever" of Louis, under unfavorable management a contagious disease, and spreading by means of contagion to a wide extent, and depending upon a specific poison, as is the case in scarlatina, variola, etc., is, under certain conditions of the system, more likely to make its advent. Among the causes favoring these conditions and predisposing towards it, as shown by experience, is the decomposition of animal and vegetable matter, and particularly the decomposition and dissemination in the air and water, of animal excrement. The advantages of draining in the removal of the surplus water of the subsoil and permitting the absorption of the dangerous and poisonous decomposing matters from the surface of the soil, and the influence of sewerage upon this disease has been well marked; and it is usually the case that some defect in the proper drainage and sewerage is observed when this disease appears in an endemic or epidemic form.

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\*Dec. 31, 1873, 92 miles, 3965 ft. 6 in. Rept. Sewer Comm., 1874.



## STATE BOARD OF HEALTH—REPORT OF SECRETARY.

A form of this fever, but of a much less fatal type, known as "Typho-malarial Fever," is not unfrequently associated with malarious fevers, and seemingly depends largely upon a malarial origin, and is much more frequently observed in low and deficiently-drained regions. The slow decomposition of wood, as the sills of dwellings or flooring of cellars, or the decomposition of vegetables and fruits in cellars, is a frequent cause, in the opinion of this committee, of this fever. This fever prevails in the seasons of the year when malarial poison is most active, and presents many of the symptoms of malarious fevers in its earlier stages, though later the typhoid symptoms usually predominate, and after death the pathognomonic lesions of enteric fever are found present. Thorough sewerage and drainage of the premises, and drainage of neighboring marshes and low places in the vicinity is most gratifying in its results in removing this disease.

Diphtheria has been found to choose the cold and damp seasons of the year, and to effect more largely and more fatally that portion of the community residing in the lower and less-perfectly drained portions of the city and country.

Phthisis Pulmonalis, or Consumption, that scourge of the human race, is particularly influenced by the amount of moisture in the soil, and the consequent effects of this upon the temperature and humidity of the atmosphere.

The researches of Dr. Buchanan in England, made and published under the direction of the Privy Council,\* as well as those of Dr. Bowditch, of Massachusetts, published 1868, are familiar to all who have studied this disease with reference to climate.

These observations show beyond denial the fact that "residences upon damp soil tends to the production and promotion of consumption in New and Old England."

It is to this source that Dr. Bowditch ascribes the chief causes of consumption.

Asiatic Cholera has been found to show a decided partiality for the lower portions of the cities wherever it has appeared; showing that the emanations from saturated soils are particularly favorable to its progress.

To obviate many of these diseases, as well as to lessen the gravity of those which can not be entirely eradicated, sufficient has been said to show the imperative necessity that exists in locating a village or a homestead, to make the selection of ground which is capable of being thoroughly drained throughout its whole area.

If thorough draining will eradicate some diseases entirely, and lessen the frequency and severity of those which can not be entirely removed, if it will so generally permit the healthful and vigorous development of the children, and continue the vigor of adult life into old age, should not the location and drainage of the homestead become of paramount importance among all classes and conditions of people?

We hope at some future time to enter more into the local bearing of this subject in this State, and to treat it in its relations to particular districts and towns; convinced, as we are, that drainage for health will in time become estimated by the many, as it now is by the few, one of the most important and personally interesting branches of all sanitary science.

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\*Vide 9th and 10th reports, 1866-7.

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# POISONOUS PAPER.

BY

R. C. KEDZIE, M. D.,

MEMBER OF THE STATE BOARD OF HEALTH, AND CHAIRMAN OF THE  
COMMITTEE ON POISONS, ETC.

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## POISONOUS WALL PAPER.

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A short article, calling attention to the danger arising from using arsenical wall paper, was published in the first report of the Secretary of this Board. The publication of this article brought to light so many cases of prolonged ill health, caused by such wall paper, that the Board became satisfied that it was necessary still more effectually to put the people on their guard against this insidious danger.

The use of arsenical wall paper is so injurious to the health, the symptoms of poisoning by its use are so easily mistaken for those of other diseases, its use is already so common, and threatens to become more general unless the people learn the gravity of their danger, that the Committee on Poisons offers no apology for again calling public attention to this subject.

During the few months past, instances like the following have been of frequent occurrence: A party of visitors calling at the laboratory of the Agricultural College, had their curiosity excited by a book of specimens of poisonous wall paper. One lady examined them with great interest, and inquired the symptoms of poisoning by such wall paper. I gave her the leading symptoms,—chronic headache, especially in the forehead, sore throat, catarrh, cough, loss of flesh, neuralgic pains, dyspepsia, faintness, prostration, etc. She turned to her husband, and exclaimed: "He has given exactly the symptoms of our daughter's illness, which came on soon after papering our house, for we have not a room which is not papered with this poisonous paper!"

The husband promised to send a specimen of the paper and a full account of their experience in its use, and I have just received the paper, and the following letter:

BENNINGTON, Oct. 26, 1874.

*Prof. R. O. Kedzie:*

DEAR SIR—Yours of the 22d is received, reminding us of the promise we gave you at the college some time ago. Please excuse our unintentional neglect.

I believe we related to you a little experience we had with wall paper about two years ago last June. Early in the month, my wife and hired girl put wall paper on a bed-room in the northwest corner of the house. The paste used was made of fine wheat flour and water. The paste was spread out of doors. While putting on the first roll an unpleasant odor was observed, and by the time the second roll was on we were so affected with dizziness, nausea and fatigue as to leave off the work a little before eleven o'clock A. M. After dinner the work was resumed, and with the same results; upon which we concluded that the paste produced some peculiar effect upon the colors in the paper, which would pass off after the paper had become dry. At no time could the work be continued more than two hours at a time. After the paper was all on, we allowed the room, which was empty, to stand open some two weeks, which we thought sufficient to dry the paper. We then put in the bed and other furniture. Wife and I slept in the room, a night at a time, some eight nights at different intervals during five or six weeks. We noticed every morning,

after sleeping in the room, that we were affected with more or less headache and other bad feelings, which would pass off during the forenoon. The color of the paper I do not distinctly remember, except a bright, green stripe, but what proportion it bore to the other colors I cannot tell, as we did not save a sample.

The removing of the paper was attended with the same difficulty that marked the putting on, but which disappeared after the paper was removed.

I send you a sample of the paper which has been on the sitting-room wall a little more than two years. I applied your test to the paper, with the same results, I think, that marked your tests with arsenical wall paper. But how far the health of any members of the family may have been affected by it, if at all, we are unable to judge, as lassitude, headache, tenderness of the throat, lungs and eyes, with general debility, are effects we can see more easily than we can trace to causes. If, after removing the paper from the wall, the symptoms above described pass away, we will apprise you of the facts.

If what we have here stated is of any use to you, or any part of it, you are at liberty to use it as you deem best.

Respectfully yours,  
G. R——.

The paper was analyzed, and found to contain arsenic in dangerous quantity. That this danger is not confined to this State, is shown by the following letter. I had received from Leavenworth, Kansas, a package of wall paper, with a request to analyze it, and send the results to the writer. I made the analysis, and found plenty of arsenic in the paper, and on communicating the results of analysis, I requested a history of the case, and received the following:

LEAVENWORTH, KANSAS, August 22, 1874.

*Prof. B. C. Kedzie, Lansing, Mich.:*

DEAR SIR—I have received your favor of the 17th, and hasten to give you the particulars of my case.

Four years ago this summer, I had my room papered with paper same as sample sent you. The room is 18 feet long, 15 feet wide, and 12 feet high. For about three or four years, I have been greatly troubled with dyspepsia, indigestion, loss of appetite, and a general feeling of lassitude and depression, though there has been no cause for it that I could discover, unless it was chewing tobacco. Two years ago I gave up the use of it altogether, but I do not see that it has made any difference in my health. My mind has been clouded, and it has been impossible to study or read, as I could not keep my thoughts on my book. I have gone to my room, night after night, feeling "first-rate," and upon getting up next morning have felt quite sick, and often wondered if there was not some cause for the change in my own room, and have taken particular pains to air the bed clothes and room.

About a month ago I removed from the papered room to an unpapered one in the same building, but have not changed my mode of life in any particular, so that I might be able to fully test the matter.

I have not been in the unpapered room long enough yet to expect any benefit from the change. I will write again after sufficient time has elapsed to give the matter a satisfactory test.

Yours truly,  
E. B——.

That danger from arsenical paper is not confined to wall paper is obvious when we consider how frequent is the use of bright green arsenical paper in ornamenting boxes, etc. A book-binder, not long since, was found lining show boxes for candies with this deadly paper. I called at the house of a friend the other evening, and found the bright babe with a green box in his hand, which he was freely applying to the infantile catch-all, the mouth. The prospects for an early funeral, and reflections on "an inscrutable Providence," were very fair for a time.

Some months ago I received the following:

LA CROSSE, WIS., April 4, 1874.

*Prof. B. C. Kedzie:*

DEAR SIR—Noticing your article on the effect of green color in papers, etc., the other day, seemed to explain a curious circumstance; I have in my stock a lot of wax table mats,

## POISONOUS WALL PAPER.

57.

German manufacture, the backs a dark green. Whenever I have been compelled to handle these goods I have soon after been seized with violent headache, accompanied with blindness and nausea.

Your explanation of the arsenic poison in the paint is doubtless true in this instance, and so to confirm all things, I add my testimony.

I am, yours truly,  
J. W. TOMS.

In view of all the facts in the case, the State Board of Health became satisfied that they had not discharged their whole duty by simply telling the people that arsenical wall papers are dangerous. They need to be told that such dangerous papers are freely offered for sale in every wall paper store in our State, and that only by using good judgment and scientific tests can they certainly avoid this danger. To this end, the people need information and assistance in detecting these poisonous colors, so that they may avoid them. These colors are often so disguised by combination with other colors that persons may have no suspicion that such dangerous materials are present. It is frequently impossible to decide by the eye alone whether the arsenical colors are present.

As a means of educating the eye to detect these poisons (so far as it is possible) and to make the public aware how often this poison is found in the most innocent looking paper, the Board directed the Committee on Poisons to prepare 100 books, of specimens of such poisonous papers, to be placed in as many libraries in this State, for the information of the public.

The paper for these books was selected from first-class dealers in Lansing, Jackson and Detroit, and are such wall papers as are to-day offered for sale throughout the State.

The book of specimens was inscribed:

### SHADOWS

FROM THE

## WALLS OF DEATH;

OR

### ARSENICAL WALL PAPERS.

GATHERED BY R. C. KEDZIE,

MEMBER OF STATE BOARD OF HEALTH.

And behold if the plague be in the walls of the house, with hollow streaks, greenish or reddish, then the priest shall go out of the house to the door of the house, and shut up the house seven days. \* \* \* \* \*  
And he shall cause the house to be scraped within round about, and they shall pour out the dust that they scrape off without the city into an unclean place.—*Leviticus*, xiv.

The following article, explanatory of the objects, uses, and design of the Book of Specimens, was inserted as a preface to the book:

#### ARSENICAL WALL PAPER.—SHALL WE POISON OUR HOMES?

That arsenic is a deadly poison is an admitted fact. When taken internally, in any appreciable quantity, the gravest results are anticipated by all intelligent persons. If a person should thoughtlessly mix arsenic with the food of another person, he would be accused of criminal carelessness; if he were detected in purposely adding it to the food of another, he would be arrested for an attempt to commit murder. But whether a poison is adminis-

tered in ignorance, by carelessness, or by design, *the effect of the poison is all the same.*

Arsenic may enter the body by other avenues than by the mouth, for it may be absorbed by the skin or inhaled with the breath. The danger for equal doses of the poison is vastly greater when it is inhaled than when it is swallowed, for we take food only at distant intervals, while we breathe continuously. Persons engaged in smelting arsenical ores are compelled to use extraordinary precautions to avoid inhaling the fine arsenical dust, on account of the great danger of poisoning by this means.

Perhaps we could not devise a more effectual way to contaminate the air of our homes with a small amount of arsenical dust, than by the use of wall paper colored with arsenical preparations. The large amount of surface exposed, the feeble adhesive power of the size by which the pigments are fixed, the frequent alternations of heat and cold, moisture and dryness, by which the adhesiveness of the size is still more diminished, the currents of air always circulating in a warm room, mechanical displacement by sweeping, dusting, etc., all combine to dislodge the pigments from their position on the paper, and to scatter them in the form of a fine dust in the room, and this dust may be many hours or even days in settling. That the air of every inhabited room is filled with finely divided particles of matter is clearly seen when a ray of sunshine is admitted into a darkened room. That this dust contains arsenic when the walls are covered with arsenical paper, has been demonstrated by analysis of the dust which had settled on the furniture. This suspended dust is swept along with the air in inhalation, and is lodged upon the mucous surface lining the nasal cavities, the windpipe and its ramifications. The mucous surface of the air passages is as truly an absorbing surface as is the mucous surface of the alimentary canal. Arsenic applied to any absorbent surface, besides being taken into the general circulation and producing constitutional effects, may produce a local inflammation in the surface to which it is applied. This may explain the frequent occurrence of catarrh and bronchitis in those persons who occupy rooms papered with arsenical wall paper.

In connection with these local diseases, symptoms of a more profound and alarming nature may present themselves, showing that the constitution is becoming undermined. Dyspepsia, neuralgia, pains in the bones and joints simulating chronic rheumatism, headache, general debility, etc., are symptoms which often attend this form of chronic arsenical poisoning; for arsenic may show its deadly power not alone by sudden and violent destruction of life in acute poisoning, but it may take on the forms of many chronic diseases. Thus the constant cough, loss of flesh, depression of spirits and general failure of the vital powers may lead the person to fear that pulmonary disorder of an alarming type is threatened. How many women have thus "gone into a decline," I will not venture to guess. Perhaps a consideration of the "delicate state of her lungs" leads her to confine herself to her room, and the fear of "taking cold," to avoid all ventilation; and thus she breathes constantly an air loaded with the breath of death. Possibly, by advice of physician or friends she "travels for her health," or visits some medicinal spring. By this prolonged absence from the cause of her illness, she regains her health in some degree, and returns home confident that the "change of climate," etc., were the cause of her improved health. But a return to the old home brings back, after a time, all the old symptoms. Perhaps she may abandon all hope

of complete recovery, shuts herself up to avoid all possibility of "taking a fresh cold," and finally succumbs to consumption,—a consumption of arsenic in every breath she inhales!

I would not lead any one to suppose that every case of consumption or of chronic disease springs from arsenical poisoning, but I verily believe that the picture I have drawn, has its corresponding reality in too many homes in our land. If so deadly a cause of disease, and one so easy of removal, lurks in our homes, it is well to call public attention to it, not only for the recovery of those now sick, but also for the prevention of future illness of those now well.

#### WHO IS RESPONSIBLE?

The question naturally arises, who is responsible for this dangerous use of poisonous colors in wall paper? I think the retail dealers, for the most part, are innocent in this matter, for most of them are ignorant of the composition of the coloring matter, and are not aware of the danger of its use. When their attention has been called to the subject they have expressed surprise that such materials are used, and a determination to avoid buying any more of such dangerous material. But the manufacturers cannot enter a plea of ignorance, for they know the materials employed and the danger of their use. Dr. Draper, in the Report of the State Board of Health, of Massachusetts, states that a paper printer cannot work more than two or three weeks at a time with arsenical pigments; he must then change his work to enable him to sufficiently recover his health to again begin printing in arsenical colors.

#### THE DANGER IS INCREASING.

The danger arising from the use of arsenical wall paper is increasing. Good taste revolts at the use of wall paper with strongly marked colors and sprawling bouquets, but is gratified with toned papers in subdued colors. A delicate shade of pea-green satisfies the eye much better than a blank white wall. These toned papers, with no figures, or only a delicate tracery of vines and flowers, are becoming very fashionable, because very beautiful. There is not in commerce a green paint so beautiful and unfading as the aceto-arsenite of copper. When mixed with other colors in toning it still gives a clear and fresh color. The temptation for the paper printer to use it is very strong. It is often used to give a delicacy to the shading where the unpracticed eye would fail to detect any shade of green. This arsenical green is too costly to be used in the ground-work of cheap paper; in these the green ground-work is usually a vegetable color, and the arsenical green is usually employed to imitate leaves of plants, vines, etc., or in printing bright stripes of green, and is then readily detected by the eye. But in toned paper the arsenical green is often so disguised by combination with other colors as to escape notice, and the danger is increased by the fact that the whole surface of the paper is spread with the poison.

A short time since I examined the specimen book of one of the largest wall-paper houses in this country. Many of these papers were very beautiful and very dangerous, for the arsenical colors were freely used in their toning. The agent jocosely asked me to write a puff for his house. I told him that if he would give that book of specimens I would analyze each paper and write a puff of his house that would go into every paper in the country! The agent declined with thanks. Yet these deadly papers are offered for sale in every city and important village in our State, and their use will become



more general unless an enlightened public sentiment shall banish them from our homes, or the Legislature by law shall hold the shield of its protection over the heads of our people. But any legal enactment on this subject, not sustained by an enlightened public sentiment, will remain a dead letter upon the statute book. To awaken such a public sentiment, to call attention to this source of danger, and to assist persons in detecting these dangerous colors in wall paper, the State Board of Health directed me to prepare specimen books of such dangerous wall papers, to be placed in every important library of our State. The wall papers in this book all contain arsenic; they were selected from stores in Lansing, Detroit, and Jackson, and were all on sale in these cities. The attention of a health-loving public is respectfully called to them.

#### THE DANGER IS REAL.

To show that the danger from using arsenical wall paper is no figment of the imagination, I present a few cases that have recently occurred in this State, which will illustrate the influence of such wall paper.

#### CASES OF POISONING.

1. Dr. I. H. B., Lansing, member of House of Representatives for this district in 1873, and his two boys. The Doctor's bed-room was papered with wall paper of a grayish color, toned with green, and had a few bright green flowers or leaves. His boys occupied a bed-room next to his, and the door between the rooms was open at all times. The Doctor was troubled with severe pains in the bones, symptoms of chronic rheumatism, and constant cough. The boys became affected with pains and rheumatic soreness. Suspicion was aroused that the wall paper might be the cause of this illness, and the paper was analyzed, when it was found to contain 5.47 grains of arsenic to each square foot, or six ounces of arsenic on the walls of a single room. The paper on the wall did not look faded, but on comparing a fresh piece of paper with that on the walls, the Doctor declared that half of the coloring material had disappeared. If his estimate was correct, then an ounce of arsenic had been set free in his bed-room, in the form of fine dust, every six months.

The wall paper was at once removed, and the Doctor and his boys have entirely recovered.

2. The children of Hon. L. D. W., of Manchester, formerly State Senator. Emma, aged 9, occupied a bed-room, the walls of which were covered with paper of a greenish stone color, with bright bands of green. Soon after occupying the room she exhibited the following symptoms: Lameness resembling rheumatism, darting pains in various parts of the body, languor in the morning, feverishness, pains in the head and frontal sinuses, sores in various parts of the body, faint spells, turning white about the mouth, and great loss of flesh. The best medical advice that could be procured was obtained, but no essential improvement followed. Whenever she left home for a time her health improved, but she relapsed into her former condition on returning home.

The paper on the wall was analyzed and found to contain 4.87 grains of arsenic to the square foot. Emma was removed from the room and entirely recovered her health.

Last fall the son, Herbert, aged 6, was allowed to occupy the same room. In a short time all the distressing symptoms which afflicted Emma were

developed in Herbert. He was removed from the room and entirely recovered.

3. Mrs. J., of Saginaw, occupied a room, the paper on the walls of which had bright green figures. She had been an invalid for some time, had traveled for her health, which always improved when away from home, but she always relapsed on returning home. She particularly observed an increase of her unpleasant symptoms after sweeping or dusting her room. The wall paper was analyzed and found to contain one-half of a grain of arsenic to the square foot. The paper was removed from the walls at once. A short time ago I received a letter from her physician, Dr. L. W. Bliss, in which he says: "Since removing the paper, and re-papering with paper free from *green*, Mrs. J. is free from headache, loss of appetite, and neuralgic pains, all of which she had before except when away from home for some time."

4. Mr. H., a prominent lawyer of Mason, had his house papered with wall paper, which contained a considerable quantity of green. Soon after, Mrs. H. and all the children passed into a condition of continued ill-health. The time of the commencement of this poor health was so nearly identical in all the cases, and the symptoms were so similar, that Mr. H. was convinced that there was some common cause operating on his family to cause this mysterious sickness; but he was not able to find any thing in the condition of his home or its surroundings which would explain it. When examining the Report of the State Board of Health, his attention was called to poisonous wall paper as a possible cause of ill health. The wall paper in his rooms was analyzed and found to contain 1.88 grains of arsenic to the square foot. The paper was at once removed from the walls and Mrs. H. and the children have recovered their usual good health.

5. On the 3d of July I received the following letter:

SPRINGPORT, Jackson Co., July 2, 1874.

*B. C. Foote, M. D.:*

DEAR DOCTOR,—A case of sickness and death took place here, not long since, under peculiar circumstances. I was not the attending physician, but having an acquaintance with the family, I inquired into the case. I found the child, aged about ten years, had complained for some time of wandering pains in her limbs, back, etc., was pale and fretful, and at last they called in a Doctor who pronounced it a case of "spinal fever." In a day or two they called a council of Homœopathic Doctors, who diagnosed "rheumatism of the heart." She was sick but a few days, when she died. I called upon the family, when I observed that the walls in nearly every room were covered with green paper, of the shade which I send you. It may be well to state that the other members of the family enjoy very poor health.

After reading an article in my journal, I thought I would obtain a specimen of the paper for analysis, and for that purpose I send these specimens. Please let me hear your report.

I am, with much respect, yours truly,

L. A. FOOTE.

By analysis, arsenic was found in both specimens of paper. I afterward learned from Dr. Foote that one specimen of paper was from the bed-room occupied by the girl, and that this paper had been on the walls about two years. There was not enough paper sent to make a quantitative analysis. The other paper was from the room next to the girl's room, and was put on last spring. It contains 1.16 grains of arsenic to the square foot. A specimen of this paper is bound up in the book of specimens, being the first specimen leaf of the book.

These are not all the cases which have come to my notice, but they may be regarded as representative cases, and are sufficient of themselves to arouse the attention of all who love life and hate death.

## REMEDY.

The question how to avoid such dangers becomes an important one. A sweeping rule may be given by saying *use no wall paper of any kind*. If persons dislike the naked white wall and are not satisfied with kalsomining (which may be tinted of any hue desired) the walls may be frescoed or painted to suit the taste. The oil will fix any color upon the wall in such manner as to obviate all danger of the color dusting into the room.

If wall paper is used, **BE SURE THAT IT IS FREE FROM ARSENIC IN ANY FORM.** *Test the paper for arsenic before you use it, and if the poison is present in any quantity, reject it entirely.* The means of testing the paper may be found in any drug store in the State.

If arsenical paper is already on your walls, and if, for any reason, you do not wish to remove it, the paper should be varnished with a thin and transparent varnish, to securely fix the pigments on the paper. It will usually be cheaper to remove the paper entirely, and to replace it with paper free from poison, than to varnish the old paper.

## METHOD OF TESTING.

The green arsenical colors are readily soluble in ammonia water. If a little ammonia water poured on the paper discharges the green color, or produces such a change in the color as indicates the removal of green, the paper should be rejected, as it probably contains arsenic. To identify the presence of arsenic in any paper, wet the paper with ammonia water, pour off this water on a clean piece of glass and drop into this a crystal of nitrate of silver, or a small piece of lunar caustic. If a yellow precipitate forms around the crystal it indicates the presence of arsenic.

In behalf of the State Board of Health.

R. C. KEDZIE,

*Chairman of Committee on Poisons, etc.*

AGRICULTURAL COLLEGE, LANSING, Sept. 26, 1874.

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# THE RELATION OF SCHOOLS TO HEALTH.

BY

REV. J. S. GOODMAN,

SUPT. OF SCHOOLS FOR THE COUNTY OF SAGINAW,

AND MEMBER OF THE

STATE BOARD OF HEALTH.

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## RELATION OF SCHOOLS TO HEALTH.

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### THE KIND AND METHODS OF INSTRUCTION IN USE AND METHODS TO BE PROPOSED.

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"The State Board of Health shall have the general supervision of the interests of the health and life of the citizens of this State. \* \* They shall make sanitary investigations and inquiries respecting the causes of disease, \* \* and the effects of localities, employments, conditions, ingesta, habits, and circumstances on the health of the people."

So reads a portion of the second section of "An act to establish a State Board of Health," etc. And it is in accordance with this section and in compliance with its provisions that this paper is written. At its very outset it may be,—if not absolutely necessary, at least advisable,—to observe that whatever of criticism of our present school system may find place therein is most certainly due to no hostility toward it, but solely with a view of so calling attention to whatever may deserve such criticism as to secure its speedy and thorough removal. In the language of the Mass. State Board of Health: "Like every other occupation, school-going must have its liability to peculiar hygienic disadvantages." Let us seek to discover them and also the means whereby they may be reduced to a minimum. As citizens of Michigan, we are proud, justly proud, of our school system,—proud to know that to every boy and girl the means of obtaining an education are furnished; that from the primary school to the University the doors are ever open; and to these halls of science the lofty and the lowly are alike made welcome. We hold our schools as precious, and therefore is it that we will do our best to rid them of whatever may tend, in even the smallest degree, to diminish either their value or the estimation in which they are held.

In dealing with this subject, not the least of my difficulty has grown out of the fact that apparently so little attention has been given to it in time past, especially in this country, *i. e.*, if we may judge by the paucity of documents relating thereto. In the Report of the Commissioner of Education, for 1872, speaking of the health of the school population of the United States, he intimates that the department has been engaged in collecting materials on this subject, and says that such materials will be published at an early date. Whether that time has yet come, I am not advised, at all events, I have not been fortunate enough to obtain any such publications. In the preparation of this paper, I have endeavored to avail myself of all the information within my reach, and have not hesitated to make use of anything that seemed to me to

have a bearing on the case before us, and to be at the same time reliable. In fact, this paper is largely made up of quotations, the only originality about it being the arrangement and interweaving of its several parts. Perhaps I ought just here to observe, that in many instances I have given rather the substance than the exact language of the authorities quoted, and that, in these cases, I have not deemed it necessary to use quotation marks.

Is, then, the present system of school education conducive to the health of those engaged therein? That this is a question whose consideration is worthy of the most careful attention, needs no long argument to prove. With three hundred thousand children in our schools, for a greater or less share of the time, with nine or ten thousand teachers actively engaged in school work, for a period of from four to ten months of each year, it cannot be otherwise than important to consider the relation which this work sustains to the health of those engaged therein. Nor is it in the number of those thus employed, whether as teachers or pupils, that we find the sole ground of this conclusion. The time at which this work is done, is an element of no small value in the consideration of this subject. That the years of school life are—especially in the case of the scholars—by far the most important, the most pregnant with future results, is beyond dispute. That influences, at this time brought to bear upon us, are most enduring and most powerful,—that our entire subsequent lives are effected thereby, few will care to question. It matters little whether we speak of the mental or the physical; here will each be most likely to obtain its form and quality. And not a few of those diseases which so severely afflict us in after years, and all through, it may be, a long life, find in this period their seeding time, after life only developing the germs which school life has planted so deeply, and nourished so well. In view of these considerations, we can but feel that we are entering upon a subject of the highest importance. Nor is it, by any means, a subject of small dimensions. Into its investigation enters the entire routine of school life, together with all its appurtenances, apparatus and details. The situation and arrangement of school buildings, the position of the several rooms, whether in the basement or the fourth story, together with their size, the kind of school furniture and its arrangement with reference to warmth, and especially to light, the methods of heating, lighting, and ventilating, the length of the sessions, the number of studies, and length of lessons, all these are matters which fall within the purview of this examination, just as each and all of them contributes its quota to the sum total of results to be considered. Nor have we yet reached the limit. Not alone the points already mentioned, but others must be taken into the account. Style of dress, manner of living, employments out of school, in short, a thousand things gather around and find place, in any discussion of this subject, that shall at all deserve to be considered as exhaustive. And then, after this broad area has been gone over, after we may, perchance, have found ourselves obliged to complain of our present methods, then there comes the question, no less important, and no less practical, and even more difficult: What can be done? Are the present methods injurious? What shall take their place? Can these evil tendencies and influences be removed? Can whatever of wrong there may be in the present methods be eliminated, and the methods themselves saved, or must we have an entire and radical change? Are these evils essential or accidental, inherent or engrafted? What change—if change must come—what change shall we suggest? What new methods shall we recommend, and why shall we recommend them? Must it not be

evident, from even this hasty and imperfect outline, that a volume, not to say volumes, rather than a few pages of a paper, is needed—that months and years of investigation are necessary, rather than the intervals snatched from the work of a busy life? And must we not further conclude that at the best, we shall have only a few jottings, on this vast and complicated subject,—a few drops from the ocean that stretches so broadly before us?

#### IMPORTANT BEARING OF EDUCATION UPON NATIONAL HEALTH.

Nor is it as individuals or in our own individual capacity alone, that we are interested in this subject. It hath a reach and compass far wider than that of the individual. Looked at in these broader aspects, we can easily see how as a commonwealth, we are interested therein. As was justly observed by the School Commissioner of Ohio, in his last Report,—“the State needs for its material prosperity alone, a race of strong, healthy men and women. Inability to perform any of the duties of citizenship, through ill health, which may be avoided, and habitual violations of hygienic laws through ignorance, are matters of grave State concern.” Centuries before, the old Greek philosopher had affirmed that there is nothing better in a State than that both men and women be rendered the best possible. As a State we are interested in preventing these transgressions of the laws of health. Especially is this true where such violations and the consequences thereof are as wide-spread as they may become under a vicious system of education. If it be true, as recently asserted by eminent authority, that a wise education is the cardinal basis of national health, then must it of necessity follow, that all are interested in securing for the entire school population the most perfect possible system of education. Dr. Mesnil of France, makes the following statements based upon an examination of the books of recruitment.

1. Those departments in which the proportion of ignorant persons is greatest, are also those in which the mean of life is shortest, and the stature of the inhabitants the least.

2. Those departments in which instruction is most general, are the ones in which the mean of life is greatest and the stature most.

The less instruction, the greater mortality, and vice versa. He concludes that it is impossible “to separate ignorance, misery, and mortality.” Physical degeneracy, especially if wide-spread, is a sure precursor of national inferiority. Nor is this a short-lived evil. The physical weakness of to-day perpetuates itself. Nothing, I think, can be more certain, than that in this direction the sins of the parents are visited upon the children. Scarcely do we expect a race of pygmies to produce a race of giants. The theory of the “survival of the fittest” may not be true in all its parts, as sometimes advocated, and yet, it hath in it not a little of truth, when applied to national strifes for existence. That there is something wrong somewhere,—something which demands and deserves serious attention, is affirmed by not a few of our best informed writers and scholars. Says Dr. J. M. Toner—“It is proper that the profession and the country should be made acquainted with the facts, and made to realize that the American people in this particular—the decrease of the birth-rate among the native population—are showing unmistakable signs of physical degeneracy.” The same gentleman, in an article published in the Nation of Aug. 28, 1873, has this statement: “It is a fact not to be lost sight of, that the proportion between the number of American children under fifteen years of age and the number of American women between the child-bearing ages of fifteen and



fifty is declining steadily. In 1830 there were to every 1000 marriageable women, 195½ children under fifteen years of age. Ten years later there were 1863, or 89 less children to every thousand women, than in 1830. In 1850 this number had declined to 1720, in 1860 to 1666, and in 1870 to 1568. The total decline in the forty years was 384, or about 20 per cent of the whole proportional number in 1830, a generation ago. The United States census of 1870 shows that there is, in the city of New York, but one child under fifteen years of age to each thousand nubile women, when there ought to be three; and the same is true of our other large cities."

Dr. Snow, of Rhode Island, who investigated this matter in 1868, gives the percentage of births in the city of Providence, for thirteen years, as 39.29 for American parents against 51.87 for foreign. So far as our own State is concerned the question seems to be an open one with the weight of evidence strongly in favor of the larger increase of children of foreign parents. How far the present system of education is, either in its matter or manner, responsible for this state of things, is a question that may well occupy the attention of thinking minds.

#### SCHOOL-ROOM DISEASES.

Let us now inquire whether of all the multitudinous ills to which flesh is heir, any of them are directly or even indirectly traceable to our prevalent methods of education; in other words, is there a class of diseases to which we may with any degree of appropriateness give the name of "School-room Diseases?" On this part of our subject we quote largely from an article in the First Biennial Report of the California State Board of Health, the article itself, consisting mainly of a translation of a paper by Dr. R. Virchow of Berlin, and published first by the Department at Washington in 1870.

This subject,—Diseases of the School-room,—one of the gravest importance to the future of our nation,—deserves much more attention than has hitherto been devoted to it. He fears that too exclusive care has been bestowed upon the mental development of the young, leading to a forgetfulness of the old adage, "A sound mind in a sound body." This neglect has already borne its evil fruit, and its thorough investigation is demanded. The fact of the detrimental influences of school-life upon the health of children,—though it has frequently attracted the attention of physicians and educators,—has but very recently been made the subject of scientific research. A few general experiences or apparently well-founded assertions began to creep into the books, but rather as matters of question than as based upon established facts. Now and then sporadic attempts were made to obtain statistics of school diseases, but to small purpose, and without the facts there was small foundation on which to build. General scientific rules might guide, but still many important points must be overlooked because unobserved, and hence mistaken judgments might easily arise. Trustworthy and extended comparative statistics are the only means of forming a clear judgment on the evils or diseases produced by schools, and on the true way of remedying them. In this article he distinguishes carefully between evils whose existence is established by facts and those whose existence is only surmised. He mentions as prominent among the former—

##### *1. Eye diseases, especially short-sightedness.*

About the beginning of the present century, an Englishman, one Mr. Ware, made the first investigations on this particular point. Subsequently other inquiries were set on foot, but in a very indefinite and unsystematic, and there-

fore unsatisfactory manner; and it was not till 1866 that Dr. Herman Cohn published the results of thorough, systematic investigations. He examined five village schools in Langebielen, a village of Silesia, and twenty-eight schools and colleges in the city of Breslau, containing in the whole 10,060 scholars, and comprising all grades, from elementary to collegiate. In addition to these, he examined personally 410 students of the University of Breslau. Of the 10,060 scholars, 1,720, or 17.1 per cent., were not in the full normal possession of their eyesight. Taking the several schools, the following shows the tabulated results:

In the village schools.....	5.2 per cent.
“ city elementary schools.....	14.7 “
“ intermediate schools.....	19.2 “
“ *real schools.....	24.1 “
“ higher girls' schools.....	21.9 “
“ gymnasia.....	37.7 “
Of the students of the University.....	68.0 “

Leaving out of the question certain actual diseases of the eye, the near-sighted reached ten per cent. of the whole, distributed as follows:

Village schools.....	1.4 per cent.
City elementary schools.....	6.7 “
Higher girls' schools.....	7.7 “
Intermediate schools.....	10.3 “
Real schools.....	19.7 “
Gymnasia.....	26.0 “
University students.....	60.0 “

One fact set forth in these tables deserves special note,—the steady increase of near-sightedness from the lower to the higher grades. An examination of the several schools taken separately gives a similar result, as is shown by the following Table, in which the classes are numbered from 6 to 1, 6 being the lowest and 1 the highest grade:

	6.	5.	4.	3.	2.	1.
Elementary Schools.....	---	---	2.9	4.1	9.8	9.8
Gymnasia.....	12.5	18.3	23.7	31.0	41.3	55.8

Nor is this all. Not only does the number of cases increase from one class to another, and from one grade of schools to another, the degree of short-sightedness also increases. Of course it is not at all supposable that this comparatively enormous amount of myopia is to be attributed exclusively and alone to school influences. That there were other causes and other influences outside of school-life at work, it might not be safe to deny. More thorough and extended researches must be made,—and that, too, among those of the same age who are not at school,—as, for example, among those actively engaged in mechanical and agricultural pursuits. One thing Dr. Cohn regards as certain,—that of the young men of the same age as the scholars of the first class of a gymnasia, there are not on an average fifty-five per cent of short-sighted persons; and among those of the same age as the University students, not sixty per cent. In this country, so far as I have been able to learn, but two tests have been made. These were in the towns of Winchester and Wakefield, both in Massachusetts. In Winchester, out of 72 scholars examined, eight, or about eleven per cent were found to be short-sighted in a greater or less degree,

\*Non-classical college.

varying (as says the report) from slight to very. In Wakefield, out of 168 scholars thus tested, fifty (50) or nearly thirty per cent were similarly affected. It should be remarked in connection with this statement, 1, That the scholars thus examined were from all grades; and 2, That the teachers were asked to send out no child whose sight was known to be defective.

Of the causes of this and other diseases we shall speak hereafter.

*2. Congestion of the Cerebral Circulation.*

Three evils arising from the congestion of blood in the head have recently been made the subject of investigation by Drs. Guillaume and Th. Becker, viz.: (1) Headache, (2) Bleeding at the Nose, and (3) Goitre. With reference to the first of these, viz.: Headache, Dr. Guillaume found among 731 scholars of the College Municipal, in Neufchatel, 296, or more than forty per cent., who frequently suffered from headache. Girls seemed more subject to it than boys in the proportion of fifty-one to twenty-eight. Here, in distinction from the former trouble, the younger suffered more than the older. Dr. Becker examined 3,564 scholars of all the public schools at Darmstadt and Bessungen, and of three private schools at the former place. Of this number, 974, or 27.3 per cent. suffered more or less from headache. It was found in the common city schools the number of children afflicted with headache was particularly large in the lower boys' classes, while in schools of a higher grade the number was largest in the more advanced classes. In the highest class of the gymnasium not less than 80.8 per cent. were sufferers from headache. So far as our own country or our own State is concerned, I have not been able to find anything on this point, except that, in a paper by Dr. Kedzie, published in the First Report of this Board, we find nine school buildings spoken of where headache was prevalent.

**Bleeding at the Nose.** Guillaume found 155, or 20 per cent., of the scholars subject to this difficulty, it being more frequent among the boys than the girls in the proportion of 22 to 20. Here an evident decrease was noticed as the investigation progressed from the lower to the higher classes, especially among the boys, and what might not seem strange, most cases were in those schools where the scholars had to sit longest in the school room and had least exercise in the open air.

With reference to the third difficulty, Goitre, of which the same investigator found a large number of cases. As this disease is rarely found in our State, it has seemed proper to pass it without remark. Headache and bleeding at the nose are, on the other hand, well known school diseases; but as, even with reference to them, our experience does not warrant us in drawing any binding conclusions, it would be well if the teachers in our public schools could, according to instructions by a competent physician, keep a careful list of all such cases and compare the numbers thereby obtained with the state of the school, the class, the time of instruction, the season of the year, the ventilation, lighting, etc.

That congestion of blood in the head has a serious influence upon the mental capacities of the scholars, is beyond doubt. And that it may even produce, if allowed to become habitual, dangerous diseases of the brain, is, I believe, generally admitted. Some physicians even go so far as to make the school responsible to a large degree for epilepsy, St. Vitus dance, and even insanity. The writer of this paper has in mind one or two cases of St. Vitus dance which, if not directly occasioned by school life, were certainly greatly mitigated by removal from the school room and entire cessation from school work. On this

point, however, we have not yet such an array of facts as will enable us to speak with certainty, and until such facts in sufficient numbers shall be collected, it must satisfy us to have intimated the possibility of danger,—a possibility awaiting only a particular predisposition or a peculiar state of the system to pass at once into actuality.

### 3. *Spinal Diseases.*

The majority of those physicians who have devoted special attention to school hygiene, and a larger number of orthopedists, maintain that the school is in a large measure to blame for distortion of the spine, especially for what is called scoliosis or, curvature of the spine. Fahrner, in his work, "The Child and the School Desk" (published at Zurich, 1865), says: Since almost ninety per cent of all these distortions commence during the years of school-life, and since the character of the distortion corresponds exactly with the position occupied in writing, one feels certainly justified in considering the school as the chief cause of the disease. Dr. Guillaume says, that among 731 scholars examined, he found 218, about 30 per cent, whose spine was distorted. Orthopedists are unanimous in declaring that the majority of cases of scoliosis originate during the period of school-life. Klopsch (Breslau, 1861) sums up the result of the physicians' experiences and finds that the majority of such cases originate between the tenth and the fourteenth years. Eulenberg says from seven to twelve, and in a later essay from six to ten. As all these ages come within the years of school-life the variation is of little importance, so far as our examination is concerned. Whether the school is however the prime cause of this form of spinal disease is not quite certain, since there is as yet a great lack of reliable statistics. We might mention as against this view the well known fact that scoliosis is almost exclusively a female disease, the relative proportion being as forty-one to eighteen in a general survey, which included a great number of light cases. Taking those which are more serious and the difference is far more striking, Klopsch says that of those thus afflicted eighty-four to ninety per cent are females. Adams (in his Lectures on the Pathology and Treatment of Lateral and other forms of Curvature of the Spine, London, 1865), found among 173 cases of scoliosis, 151 females and only 22 males. Knorr, in Munich, among 72 cases found 60 females. As it seems to us however, all that can be reasonably deduced from this may be thus stated: 1. Causes other than those connected with school-life and school habits may produce this disease. 2. Whether at school or elsewhere females are much more susceptible to these influences than males. Another fact, also alluded to in the paper from which we quote, and one of importance in our consideration of this matter, is that in an overwhelming majority of cases the spine is distorted in a given direction,—toward the right side. Of 742 cases examined by Adams 619 conformed to this statement. Parrow says that among 282 cases observed by him 218, about 79 per cent, were caused by an habitually distorted position of the body. This is characterized by Guillaume as the writing position, and of course is also applicable to drawing, needle-work, etc.

### 4. *Diseases of the Respiratory Organs.*

Here we find pulmonary consumption in connection with scrofula to be most frequent. Carmichael relates that in a school which had no yard, and, consequently no recess, *i e.*, no out-door recess, there were among twenty-five girls, none of whom had any disease when they entered, seven cases of scrofula. Arnott was commissioned to examine a boys' school at Norwood, among the scholars of which,—some six hundred in number,—scrofula was quite common,

and where the rate of mortality was very large. The evil had been attributed to poor and insufficient food, but upon examination it was found that the food was sufficient and of good quality, but the ventilation was very bad. This being remedied, the scrofula gradually but entirely disappeared. The mortuary statistics of Berlin show a rapid increase in the number of deaths arising from pulmonary consumption among those of school age; as, for instance, out of every hundred deaths there were 4.81 of pulmonary consumption between the ages of five to ten; 12.96 between the ages of ten to fifteen, and 31.88 between the ages of fifteen to twenty.

In addition to these statements it may be well to say that in 1872 the Mass. State Board of Health addressed the following question to two hundred and thirty-six of its correspondents,—physicians of that State and of other localities, embracing England and Germany: "Is consumption ever caused by over-study at schools?" Answers were received from two hundred and ten. One hundred and forty-six say yes definitely and positively; seven say yes indirectly; twenty-one say no, while ten are doubtful. "In other words," I quote the language of the Report, "nearly three-fourths of the profession, as represented by our correspondents, declare that by our system of education we really tend to promote consumption." When we remember the large percentage of deaths caused by this disease, we need not wonder that the report should add, "If this be not worthy of serious thought by our people I know of no question that can be."

#### *5. Organs of Digestion.*

Under this head Dr. Virchow observes "that continued attendance at school frequently results in dyspepsia and all the evils consequent thereon."

Very brief mention is made of contagious diseases as not unfrequently finding a favorable field for extension in schools; also of certain influences detrimental to the reproductive system, together with the necessity,—a necessity far too often overlooked,—of having experienced ladies as teachers in girls' schools. Finally, on this point the writer asserts "that much more frequently than is generally supposed, injury is inflicted by inadmissible corporal punishment, by the teacher. While there are no statistics on this point the facts are beyond doubt."

#### STATISTICS NEEDED.

In closing his paper the writer comes to this conclusion,—a conclusion already reached by myself,—"that there is an almost entire want of statistical material, and that, as yet, school pathology as a science does not exist." In this connection, and as bearing on the general topic, I quote from the Report of the Commissioner of Education for 1872. Speaking of the health of the school population he observes, "The effects of healthy training on the growing mind and body of the youth, and the influences of school life in preventing, correcting, or promoting disease, are subjects so vital to the public welfare that every teacher (might he not have said every person?) should be awake to the importance of understanding them." From the census of 1870 he shows the number of deaths in a single year, of those whom he calls fit subjects for elementary, secondary, and superior instruction, was 88,551. Starting from this point he proceeds thus: "But the mortality is only an indication of the amount of disease prevalent; and the diseases incurred during school-life, or aggravated by it, prepare many victims for lingering diseases in later life, and contribute largely to the mortality of the adult population. Besides

this, many troublesome complaints not of a perceptibly fatal character are often contracted in school. Among these he places, as does the California State Report, myopia or short-sightedness, headache, bleeding at the nose, diseases of the eye and of the spine, dyspepsia, affections of the bronchial tubes and lungs, exanthematous fevers, diphtheria, and many others as induced or aggravated by school-life.

## RELATION OF EDUCATION TO INSANITY.

The Report of the same Commissioner, for 1871, contains an article under this title, "Relation of Education to Insanity," by Dr. Edw. Jarvis, of Dorchester, Massachusetts,—a recognized authority upon all questions relative to the statistics of insanity. In this article he observes, "Whatever stimulates the mind to observe, to study, to reflect, whatever demands thought, comparison or deduction, demands mental activity, and lays burdens of various weight upon the brain. There is no work of the mind without cerebral action." It matters not what the object of thought may be, whether arithmetic, grammar, geography, or the profoundest problems in science; together with the study comes the burden upon the brain, alike in kind, varying in degree. He goes on to show, that with advancing civilization, these burdens are constantly on the increase, just in proportion as each successive stage of civilization makes everwidening demands upon mankind. "Whatever the burden may be, its first demand is for brain activity. Now arises the question whether this activity of the brain has any disturbing influence upon its health, and if so, in what manner and to what extent is insanity or mental unsoundness increased by education, and, if at all, how much?" And lastly, "is this a necessary condition of educating the people, of raising them from a savage and rude state to the civilized and the cultivated?" That among savages there is little or no insanity is an opinion held by almost all travelers. In this view the writers on insanity—such men as Esquirol, Halliday, Prichard and others—men cautious, pains-taking, and thoughtful—concur. Again, then there returns upon us the question, Is modern civilization responsible for insanity, and if so, to what extent is our present system of education accountable? The article already quoted from states further, "Education causes directly but little insanity. In a table of 1,741 cases where causes are given, only two hundred and five are from excess of study, two hundred and six from mental struggles and anxiety, sixty-one from excitement,—of what kind or character is not stated,—and eleven hundred and thirty-four from business trials and disappointments. At the same time the writer seems to hold education, as at present conducted, indirectly responsible for much of this mental disorder. He says: "Education lays the foundation of a large part of the causes of mental disorders." That it does, "by unloosing the brain from its bondage of torpor, and encouraging mental activity in numberless paths of life." Opening up fields of enterprise, adding intelligence and reason to muscular strength, it stimulates energy and bold adventure. Imparting power, it fills the soul with broader, higher aspirations, proffering rewards to the ambitious, and ever whispering of higher attainments,—new worlds to conquer,—it ever stimulates to new, intenser, and more protracted efforts. "All these have their dangers, not the least of which is that some lose their mental balance, and some become insane." But while thus holding and thus writing, he is still of the opinion that education proper is not responsible for insanity. On this point he says: "This multiplication of cases of insanity

must not be charged to education as a necessary condition or consequence. It is rather due to the incompleteness and perversion of education. Some is caused by the early stimulation of precocious children, some to the pressure upon the brain in childhood and youth, but most from misapplication of education, of mental power, and the cerebral forces in the maturer periods of life." Hand in hand with advancing education come deeper and stronger emotions and passions. There is higher joy and deeper suffering, warmer love and bitterer hate. Is it then at all wonderful that there should be an ever increasing danger that the mind should lose its balance, and insanity supervene? Without quoting further from this article at present, I would commend to all the conclusion thus set forth: "From all this survey, we are irresistibly drawn to the conclusion that insanity is a part of the price that we are paying for the imperfection of our civilization, and the incompleteness of our education." Men and women of Michigan, ponder well these words. "This is not merely a present fact, it has been so in ages past, it will be so in the future; our children will be required to pay the same price until all men, women, and youths, shall be educated to know the laws of their being, and to feel and sustain their responsibility for the faithful management of the brain and mind, and the other organs and functions intrusted to their care." In connection with this, and having a direct bearing thereupon, I quote a few words from Dr. Henry Mandley, a distinguished English writer: "Another fact which deserves serious consideration, is that there has been a very large increase, of late years, in the number of the insane who have come under care and consideration." Of the influence of Education in promoting this state of things, he thus speaks: "Next to the inherent nature which every one has, the acquired nature which he owes to the circumstances of his education and training, is most important in determining the character. How often is one condemned to see, with pain and sorrow, an injudicious education sorely aggravating an inherent mischief. Where there is no innate taint, evil may still be wrought by enforcing an unnatural precocity, wherein is often planted the germ of future disease. The aim of a good education should be to develop the power and habit of what the events of life will not fail rudely to enforce, renunciation and self control, and to lead to the continual transference of thought and feeling into external acts of a beneficent kind. By the habitual encouragement of selfish feeling, and by an egotistic development in all the relations of life, a character may, by imperceptible degrees, be so framed that insanity is the natural and consummate evolution of it, while every step taken in such deterioration will so far predispose to insanity under adverse circumstances of life."

#### PUBLIC OPINION AMONG PHYSICIANS AND TEACHERS.

In addition to the statements already made, I may be permitted to quote from the Fifth Annual Report of the Massachusetts State Board of Health. It was with a view of obtaining some data as the foundation of a paper on School Hygiene, that, in July, 1873, the following questions were addressed to a large number of the correspondents of the Board:

1. Is one sex more liable than the other to suffer in health from attendance on school?
2. Does the advent of puberty increase this liability?
3. Is the injury most likely to fall on the osseous, the respiratory, the digestive, or the nervous system?
4. Does the eyesight often suffer?

5. What opinion does your experience lead you to entertain in regard to study out of school in addition to ordinary school attendance?

6. Is a single long session different in its hygienic influences from two short ones?

7. Does your observation and experience enable you to separate the hygienic influence of study from that of emulation—anxiety about rank—say of work from worry? Also from the influences of confinement, bad air, etc.?

8. Is the occupation of school-going worse, hygienically, than other occupations in which children would engage if not in school?

9. Have you any opinion based on observation of the so-called half-time system?

10. How can our schools be modified to improve their hygienic influences:

(a) As to tasks and discipline;

(b) As to physical conditions.

To these inquiries one hundred and sixty persons made answer. Of this number one hundred and fifteen were physicians, nineteen physicians and members of school committees, fourteen were teachers of experience, and six were superintendents of schools. A tabulated statement of the answers is somewhat as follows:

QUES. 1. Is one sex more liable than the other to suffer in health from attendance on school?

Ans. Females more liable than males.....	109
Males more liable than females.....	1
Liability alike for both.....	31
Neither.....	4
Not in District Schools.....	1

QUES. 2. Does the advent of puberty increase this liability?

Ans. Yes.....	120
No.....	12
Doubtful.....	9

QUES. 3. Is the injury most apt to fall on the osseous, the respiratory, the digestive, or the nervous system?

Ans. Osseous.....	3
Respiratory.....	4
Digestive.....	2
Nervous.....	97

QUES. 4. Does the eyesight often suffer?

Ans. Yes.....	56
No.....	89
Uncertain.....	13

QUES. 5. What opinion does your experience lead you to entertain in regard to study out of school in addition to ordinary school attendance?

Ans. Adverse to the practice.....	100
Favorable.....	20
Doubtful.....	17

QUES. 6. Is a single long session different in its hygienic influence from shorter sessions?

Ans. Worse, by.....	89
Better.....	10
Alike.....	3
Doubtful.....	42



QUES. 7. Do your observation and experience enable you to separate the hygienic influence of *study* from that of emulation, anxiety about rank, etc. (say of work from worry)? Also from the influence of confinement, bad air, etc.?

Ans. Simply yes.....	7
Mental influences worse.....	4
Physical influences worse.....	18
Worry worse than any other influences.....	60
Quiet, unanxious study never harmful.....	50
Unable to distinguish.....	50

QUES. 8. Is the occupation of school-going worse, hygienically, than other occupations in which children would engage if not in school?

Ans. No (in substance).....	108
Yes.....	34

QUES. 9. Have you any opinion, based on observation, of the so-called half-time system?

This question was designed to call attention to a system adopted in England as a means of providing schooling for children employed in factories and work-shops. In this way these children have secured to them for daily instruction one-half the number of hours spent in the public schools by children not thus employed. Its result there, has been to prove that these half-time scholars learn quite as much as those who are in the same schools twice as many hours in a day. To this question the answers were as follows:

No.....	135
Yes, favorable.....	6
Yes, unfavorable.....	2
Yes, favorable for factory children.....	1

QUES. 10. How can our schools be modified to improve their hygienic influences?

The answers to this question we pass for the present with the single remark that, as might perhaps have been expected, they are as varying and contradictory as can well be imagined.

While collecting materials for this paper, the writer submitted the following questions, first to the Saginaw Co. Medical Society, and afterward to the Medical Society of Bay Co.

1. Is one sex more liable than the other to suffer in health from attendance on school?

To this, in both societies, an affirmative answer was unanimously given to the effect that girls are more liable than boys.

2. What can you from your own observation say of the effects of stair-climbing on girls of from twelve to sixteen years of age?

All denounce the practice, though some of the younger members of the profession have had no case of disease clearly traceable to this custom. One of the oldest practitioners stated that he had had at least thirty cases of uterine difficulty which could be so traced. Another stated that in a village where he had been for years a member of the school board, stair-climbing had destroyed the health of quite a number of female teachers.

3. What opinion does your experience lead you to entertain in regard to study out of school, in addition to ordinary school attendance?

In answer to this, the general sentiment was decidedly adverse. One physi-

cian spoke of two cases of St. Vitus' dance, treated by himself, and clearly traceable to over-study at school and at home.

4. Where are the injurious effects of school attendance most likely to develop themselves?

Ans.—In the weakest part of the system—particularly the nervous.

5. Has over-study at school a tendency to promote consumption?

Opinions were somewhat divided. The majority inclined to give an affirmative answer.

It will be observed that the first, third, and fourth of these questions, are identical with the first, third, and fifth of the Massachusetts Board, and that the answers agree, in the main, with those given by a majority of the correspondents of that Board. I cannot allow myself to pass from these questions, without quoting a passage from an article from Dr. Henry I. Bowditch, of Boston, which I do on account of its bearing on the inquiry as to the tendency of over-study to promote consumption. He says: "Here is one of my most frequent (note this word) experiences as a consulting physician. A parent brings his child to me, in order to find out what is the matter with him. On inquiring, I find that he has been to school, very much interested in his studies; that the teachers and parents have stimulated him constantly, or allowed him, without the least care of his physical health, to study without ceasing, in order to get high marks or prizes, and to stand high in his classes at school. Instead of checking his ambition, the parent has encouraged this over-work. By marks or prizes, or competitive examinations, the greatest emulation is excited between individuals, and the weaker ones in this struggle for life, are crushed by the severe process. I find almost invariably in such patients, that the prize gained, or an examination concluded, is the signal for entire decay of physical powers, under the violent strain put previously on the mind, and with a total neglect of corresponding physical exercise. Many such, far advanced in consumption, consult me. Hence there is abundant reason for the strong opinions I hold, on the necessity of care in the education of children and youth, hereditarily disposed to consumption."

#### EVILS SUPPOSED TO AFFECT FEMALES PARTICULARLY.

Dr. Clark, in his work on "Sex in Education," a work whose main drift seems to be to give an affirmative answer to the question, "Is one sex more liable than the other to suffer in health from attendance on school," says: "It is not true that a girl can attend school, go through the routine of study, and graduate before eighteen, and retain uninjured health and a future secure from neuralgia, uterine diseases, hysteria, and other derangements of the nervous system, if she follows the same methods that boys are trained in." A little farther on he avers that the educational methods of our schools and colleges for girls are to a large extent the cause of the thousand ills that beset American women,—not, indeed, the sole cause, but a cause, and one of the most important of them all. Again, "If excessive labor, either mental or physical, is imposed upon children, male or female, their development will in some way be checked. Force that should have been expended in the production of blood, muscle, and nerve, is used up" in what he calls "the brain-work of the school-room." The words with which he commences the Third Part of his book seem to us worthy of careful consideration. Referring to what has preceded, he says: "Clinical observation confirms the teachings of physiology. The sick chamber, not the school-room,—the physician's private consultation, not the

committee's public examination,—the hospital, not the college, the workshop, or the parlor, disclose the sad results which modern social customs, modern education, and modern ways of labor have entailed on woman. Examples of this may be found in every walk of life. On the luxurious couches of Beacon Street; in the palaces of Fifth Avenue; among the classes of our private, common, and normal schools; among the female graduates of our own colleges; behind the counters of Washington Street and Broadway; in our factories, workshops, and homes, may be found numberless pale, weak, neuralgic, dyspeptic, hysterical, menorrhagic, dysmenorrhœic girls and women," who are living illustrations of the truth of his previous statements. Not that all this is due solely and alone to improper methods of education, but largely to these, in connection with other causes. Quoting from Dr. Fisher, he says: "For the sake of a temporary reputation for scholarship, they risk their health at the most susceptible period of their lives, and break down after the excitement of school life has passed away." Hence the superficial observer would not be likely to notice it. Only the flight of years develops, and hence reveals the evil seeds, when too late to prevent their growth. The writer of the paper in the Massachusetts Report, in calling attention to the answers touching this same point, says: "It is the opinion of more than seven-tenths of the correspondents that girls are more liable than boys to be injured in health in our public schools, and of eighteen-hundredths that this liability increases with the advent of puberty." He holds this as an established fact, and asserts "that State and local school boards should at once take steps to *modify our system of education in accordance with this fact, however great may be the change required.*"\* For all girls who have passed their thirteenth year he would have "such flexibility introduced into the school regimen as shall fully recognize the feminine law of periodicity, for want of which recognition our high and normal schools and the first classes of our grammar schools are injuring many and endangering all the female scholars. Only the small number of those who enter the high-school course (3½ per cent. in Boston), and the so much smaller number (scarcely 1 per cent.), that finish it, prevents the community from standing aghast at the extent of the mischief thus wrought."

#### CHIEF CAUSES OF DISEASE CONNECTED WITH SCHOOL LIFE.

Having thus far spoken of the evils which seem to connect themselves with the present system of public education,—and it may not be out of place to remark that thus far we have looked at the subject almost exclusively in its physical aspect,—the question next to be considered is that of cause. Here, for instance, are certain diseases which seem intimately connected with school-life. Can we put our hands upon something in our educational system and say, here is the cause; remove this and the diseases will also be removed? I feel well aware that in this part of this paper I am stepping upon ground which belongs more exclusively to the physician. And I had hoped that it would please the State Board of Health to appoint some one of its number to present a paper on what, for want of a better title, I will call "Avoidable Causes of Disease." Had this been done, I feel that this part of my work might have been dispensed with.

The Report of the California State Board of Health, already quoted from,

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\* Italics ours.

presents the following as being the chief causes of school-room and school-life diseases:

1. The air of the school-room, modified as to its condition by the size of rooms, number of pupils, means of ventilation, character of heating apparatus, dampness, dust, etc.
2. The light of the school-room, with its modifications.
3. Character and arrangement of school furniture.
4. Physical exercises, with all their details.
5. Mental work required; its extent, order, and length of time.
6. Punishments.
7. Drinking water.
8. Privies.
9. School apparatus, especially text books.

To this list I should certainly feel inclined to add at least two more, as follows:

10. Location of school building and position of rooms therein.
11. Social habits and way of living while attending school.

#### THE AIR OF SCHOOL-ROOMS.

That the first of these causes deserves much more attention than it has in time past received, is beyond question. I am glad, however, to know that in many places it is receiving such attention. It is coming to be more generally understood that without comparatively pure air there can be no health, and that without some means of ventilation the air cannot be kept even comparatively pure. The State Boards of Health of California, Massachusetts, and Michigan, have given special attention to this matter. Thoughtful and skillful men in different localities are making it their study, and it is to be hoped that we may soon reach, what, I fear, we have not yet attained, a system of ventilation which shall be at once cheap, practicable, and thorough. At present, in most of our school-rooms the air is very impure. Especially is this true of what we may call the better, *i. e.*, the more costly class of school buildings. With the standard of permissible impurities not higher than six (Sanitarian for April, 1873) or eight (Report of Michigan State Board of Health for 1873, page 81) parts of carbonic acid in 10,000 of air, there is scarcely a school room of these expensive buildings in which the air approximates to this degree of purity. Seven experiments in New York City gave from 14.6 to 28.1, and in one case where the windows were closed while the experiment was in progress, and in a room provided with a ventilating flue, the examination gave 32.2 parts and was discontinued only because it became so oppressive to both teachers and children. Of forty-six rooms in our own State examined by Dr. Kedzie, and described in the former report of this Board, I find but four that gave less than twelve parts of carbonic acid to 10,000 of air; twelve that gave from twelve to twenty; nineteen from twenty to thirty; and nine that gave over thirty, one giving as high as 43.29.

The writer of this paper well remembers visiting a school as County Superintendent of Common Schools. The windows were down from the top about two or three inches on both sides of the building. It being in the winter, of course the stove was well filled. The school room was by far too small for the number of children it contained,—about seventy-five, I believe,—and the air, despite the lowered windows, was positively fearful. During a recitation, one of the class,—a little girl about ten years of age,—suddenly grew pale and

was soon obliged to be assisted out of doors to keep from fainting. The teacher remarked to me that at least ten of the children had been similarly affected within two weeks.

The question may, and doubtless has presented itself to some, why pay so much attention to quantities apparently so minute as, for example, one hundred and ninety parts in a million, or, as in the case of carbonic acid, ten parts to ten thousand. On this point Dr. Angus Smith, in a paper published in the *Scottish Meteorological Journal*, says: "Some people will probably inquire why we should give so much attention to such minute quantities,—between 20980 and 20999 of oxygen,—thinking these small differences cannot affect us. A little more or less oxygen might not affect us; but, suppose its place occupied by hurtful matter, we must not look upon the matter as too small. Subtract 0.980 from 0.999 and we have a difference of 190 parts to the million. In a gallon of water there are 70,000 grains; if we put therein an impurity at the rate of 190 in a million, it amounts to thirteen and three-tenths grains in a gallon. This amount would be considered enormous if it consisted of matter in a state of putrefaction, or in fact any organic matter such as we usually find in water; but we drink only a comparatively small quantity of, and the whole thirteen grains of unwholesome matter would not be swallowed in a day,—whereas we take into the lungs from one to two thousand gallons of air daily. If, by inhalation, we took up at rate of thirteen grains of unwholesome matter per day, half a grain per hour, we need not be surprised if it hurt us. Such an amount is an enormous dose of some poisons, and yet this is not above the two-thousandth part of a grain at every inhalation. It is marvelous what small amounts may affect us, even when, by repeated action, they do not cumulate as certain poisons do. As this whole matter of ventilation belongs more directly to another committee, it is not necessary that we spend more time on it here. And so, too, of the arrangements for heating, which we pass with the single remark that it seems simply absurd to expect aught else than poor health in connection with a system of warming which allows a difference of from ten to twenty-five degrees between the temperature of the head and that of the feet,—the former being by so much the warmer. There can, I think, be no doubt that to these causes—lack of proper ventilation, and want of suitable heating apparatus,—three-fourths of the lung diseases which affect our school population may be traced.

#### DEFECTIVE SCHOOL FURNITURE.

As another fruitful source of difficulty, we mention the character and arrangement of the school furniture. On this point I cannot refrain from quoting quite at length, from the answer of one of the correspondents of the *Massachusetts State Board of Health*, as given in their *Fifth Annual Report*. He says: "My attention has been directed for several years, to the effect of position in schools upon the spinal column. I was first induced to notice it in our High school girls, from the fact that they could be pointed out from the Grammar school girls of the same age, by their awkward, stooping attitude, and swinging step, and I was led to trace it to some cause satisfactory with theory. I found in the High school, that the desk was placed so far from the seat, in order that they might have room between seat and desk to stand up during recitation, that they could not rest their books upon the desk without leaning forward to study, which fully accounted for the stooping and rounding of the spine and shoulders in six months after leaving the grammar school,—

which they did on an average at the age of twelve and a half years. After a contest of a year against the objections of teachers and some of the committee, I succeeded in having the desks placed near enough to the seats to allow the pupils to rest the book with ease while sitting erect, and in another six months the effect was apparent in all the class, as one could select by difference of form those who were admitted before and after the change. Now, then, I have investigated the cause of so much awkwardness of position of the pupils while in their seats in the primary schools, where but little care is taken in the making of small seats. In our schools they are but little better than a smooth board and support only a very small surface (over the tuberosity of the ischium or haunch bone), on either side, and an inch or two of the thigh. This small surface soon grows painful and then the children fall into all sorts of shapes to relieve the pressure on so small a surface. I then noted some of the common attitudes of the children after they had been in their seats for half an hour or more and had a measure taken of their legs under the knee (which was done by an instrument constructed for the purpose, so that the whole school could be measured as fast as the figures could be made), and this compared with the height of the chair. Now, in order to prove the effect upon the muscles, and also to show the curvature of spine, a boy twelve years old, well developed, was selected and photographed without clothing in several of these attitudes, thus showing every shade of pressure, and the effects upon the muscles,—not those under pressure, but more particularly those of the cavities, as the abdomen and thorax, and the various curvatures of the spine. A well arranged skeleton was also photographed, and, to our surprise, the same positions gave the same curvature as in the boy. I then had the same positions photographed in a chair of a different seat and back, and we obtained quite a different result. We are now putting them into a new primary school, with the hope of giving the school a more comfortable seat and a more uniform attitude, as it admits and insures a pressure over a surface at least four or six times as large as can be obtained in a common seat, and a movable desk to rest the book while studying. I should have said that the relative height of the chair for the boy in taking the photographs was the same as those in school, as near as could be." The statements here made point evidently to three defects: 1. The chair seat may be too small. 2. It may be too high. 3. It may be placed too far from the desk.

So, too, of the desk itself. That may be too high or too low; or again, may be placed at such an angle of inclination as to give rise to the difficulties already alluded to.

It is to this cause, the faulty character and arrangement of school furniture, that Dr. Cohn attributes a large share of the short-sightedness of which mention has already been made in this paper.

As a further proof that this matter is considered worthy of attention, I would state that a short time ago, in the British Parliament, Lord Monteaagle called attention to this matter of shortsightedness, affirming its increase, and intimating that the arrangements for lighting the school rooms, and the position of the school furniture are responsible for such increase. The reply is in at least one of its parts worthy of note. Among other things, it was said that as the school houses were builded and furnished, it was out of the question to think of making any change, as though the expense of a change was more to be considered than the evil consequences arising from a continuance of the existing methods.

Passing by what seems to us the comparatively small amount of evils that connect themselves with the fourth named cause,—physical exercises,—and observing only that in a majority of cases the difficulty is in the absence and not at all in the presence or the manner of these exercises, we come to what strikes us as being far more worthy of note, far more fruitful in results, and, whether we consider their extent or duration, of a far more serious character. I refer to those forms of disease caused by the mental work, or as it has been already styled, the brain work of the school room. In calling attention to this as a source of mischief, I may be allowed to repeat a sentence already quoted in this paper from the Report of the Commissioner of Education for 1871:

“Whatever stimulates the mind to observe, to study, or reflect, lays burdens of various weight upon the brain.” This brain, physiologists tell us, is the seat or organ of the mind, its instrument of thought and emotion. In connection with it are conducted all mental processes. With advancing civilization come ever-increasing burdens, ever-growing mental activity. How can it be otherwise? Opening before us, as it does, ever widening fields of research and investigation, education, by the very power it imparts, is ever urging us to more protracted and more earnest effort. I am not of those—if such there be—who believe that study,—quiet, earnest, thoughtful study,—if carried on within due bounds and limits, is at all injurious. On the contrary, just as physical exercise, rightly and fittingly taken, is not only enjoyable, but positively necessary, so a suitable and proper amount of mental exercise,—or if you like it better, of mental work,—is not only productive of pleasure, but is an actual necessity. We have already seen that the highest style of man is he who is most perfectly developed; but for this perfection of development there must be both physical and mental work. At the same time it seems equally true that there exists at least a possibility of overwork. And that this overwork is sometimes demanded under our present methods of education, is, I think, beyond question. As a sample, I quote the following from the inaugural address of O. R. Agnew, M. D., President of the State Medical Society of New York. Speaking on this very point, he says: “Some time ago a girl twelve years of age, the child of healthy parents, was brought to me broken down in her eyesight. Inquiring into the minuter history of her case, I found that she had for a long time had an average of five daily tasks to prepare and recite; that these tasks filled the early part of the day from nine till two, and absorbed most of the afternoon and evening; that she had shown some appearance of being fagged, until finally her teacher, desiring, no doubt, to apply an additional stimulus, had added to the ordinary lessons the four following questions, to be answered on the next Monday, this being Friday:

1. The names of the principal rivers in the United States.
2. The names of the principal colleges in the United States.
3. The Coral Islands of the Pacific.
4. The recent earthquakes in South America.”

Is it at all to be wondered at that her eyesight failed? Is it not rather a wonder that brain and mind did not fail as well? A little farther on he says: “No one who is called to treat diseases of the eye has failed to be impressed with the increasing prevalence of asthenopic, refractive, and neurotic difficulties among scholars of both sexes, or to be impressed by the fact that the various maladies just alluded to, are growing rapidly more prevalent in cities, schools, colleges, and other centres of civilization, or that they follow closely the extension of the more rigorous educational, and industrial systems into

the provincial towns and rural districts." The Principal of one of our largest public schools remarked: "That they got along with the children in the primary department very well in the morning, but found it almost impossible to keep them awake in the afternoon from the effort of mental strain and bad air." Dr. A. further states that an officer, high in authority, and in a position to know, told him, that he always expected to break down one-seventh of his school by the monotony and strain of the winter's work.

I know it may be claimed that these are exceptional cases, but I fear they are by no means so rare as may by some be supposed. Most intimately connected with this point comes another, and that is the means by which this increased amount of brain work is obtained. The reference now is to those *artificial stimulants* to study too commonly in vogue in our schools, such as class rank, monthly examinations, marking for mistakes or otherwise, etc., together with their attendant anxieties and worry. Says one of the correspondents of the Massachusetts State Board: "I was first led to the inquiry" (as to the evils connected with these stimulants), "from the effects upon my own children when pupils, as I found their health impaired by position, and one of them by severe pressure from *cramming*, so that she lost at least two years of her tuition in the high school by disease of the brain, manifested after her graduation.\* She nearly forgot all the last two years' labor, and I had to send her to Boston two years to regain what she had lost. She was never sick, but became anæmic (bloodless), and I feared softening of the brain. This led me to inquire if others were like her. I found that two of the class, I think, had died during vacation, who were taken sick the week after the close of the term, and one lost her place on graduation day by being taken sick that day, I believe. She barely lived, but did not study and read for months after. The same result has followed with more or less of the class nearly every year since. In my opinion this was the result of crowding, either voluntarily or from emulous motive, or as a necessity to keep place in the class." Another correspondent says: "It is only in schools of the higher grade that I have observed deterioration of health which could be ascribed to school attendance. Emulation, class rank, which makes what the readiest scholars can accomplish the standard for all, I believe to be the chief cause of over-work and consequent ill health." Again, "In the high school only does the spirit of emulation rage, and that *does seem* to add *strongly* to the influence of study in undermining the health of the competitors." From New Bedford comes this statement: "Not a class passes through our high school of which some of the girls are not compelled to discontinue a part or all of their studies for a time, and not unfrequently they cease altogether their connection with the school, too feeble to venture a renewal of their studies." Not the least unfortunate feature of this phase of our subject is, that these evils fall with the greatest weight upon those who least need and can least bear these stimulants. It is the anxious, earnest, ambitious, sensitive children on whom the pressure falls the most heavily. These,—just the ones who would do all they ought without it,—these are the ones who are thus goaded on to efforts above their strength. It is not so much even the extra study as the *constant anxiety* which ever attends both the study and the recitation. These scholars are constantly worried and uneasy, and as Dr. Winsor says, "this worry is as unnecessary as it is mischievous. The excitements to it are factitious, and we can remove them *if we choose*. They do not

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\* Italics ours.



promote *genuine study*, though they do stimulate mental effort of a sort which by no means leads to the soundest and sweetest development of mind and character." We may not pass from this part of our subject without calling attention to the fact that this increased mental effort is sometimes, and I fear lest too often, required precisely at those times when its effects are likely to be most injurious. A scholar ordinarily prompt and diligent seems all at once to become negligent and inattentive. The teacher, not at all understanding the nature of the case, but with a view of correcting the defect, says: "Well, May, you are not as diligent as heretofore. This will never do. We must increase these lessons." And the lessons are increased accordingly. The chances are that what was needed was a lessening and not an increase. The apparent negligence and inattention were signs of approaching disease, marks it may be of an overburdened brain, imperatively demanding not simply an abatement, but a positive and entire cessation from all study. The following illustration is from Kingsley's *Health and Education*: "A medical man, a friend of mine, passing by his own school-room, heard one of his own little girls screaming, and crying and went in. The governess, an excellent woman, but wholly ignorant of the laws of physiology, complained that the child had of late become obstinate and would not learn, and that therefore she must punish her by keeping her indoors over the unlearned lesson. The father, who knew that the child was usually a very good one, looked at her carefully for a little while, sent her out of the school room, and then said: 'That child must not open a book for a month.' 'If I had not acted so,' he said to me, 'I should have had that child dead of brain disease within the year.'"

In this connection it may not be out of place to allude to a custom existing in some of our schools, and one which, in the estimation of the writer of this paper, is far more honored in the breach than in the observance,—that of continuing the school session for three hours with no out-door recess. I believe that, physiologically speaking, the influence of such a practice is evil, and only evil, and that continually. I would, except in rare cases, require every scholar, boy and girl, to pass out into the open air at least once between the hours of nine and twelve. Much that might be said on this point the growing length of this paper warns us to pass unnoticed by.

Of these causes of evil, in the shape either of disease or other bodily injury, already mentioned and numbered from six to nine (inclusive) on our list, we cannot in this paper speak at any length. We pass them, therefore, with the simple observation,—already once made,—that more frequently than is generally supposed, such evils arise from these specified causes. One illustration, and that of recent date, must suffice on this occasion. It is taken from a recent journal, and is as follows: "The danger of shaking young children as a mode of punishment has been recently exemplified. A little girl, two and a half years old, was punished in this way by her mother and immediately became both speechless and senseless, lying quite inert, but in a semi-conscious state. The parents becoming alarmed carried the poor infant to a doctor, who discovered that the neck was dislocated, and the child died a short time afterward. It was stated by the mother, who was frantic at the result, that no undue violence was used." Surely too great care cannot be taken by parents and teachers lest in their attempts at correction they inflict serious and it may be lasting injury upon the children entrusted to their charge.

In the former Report of this (the Michigan) State Board of Health we find a passage on school buildings, to which just here we desire to refer, not for the

purpose of attempting to make any addition to its clear and impressive statements, but because we have placed its subject on our list of evil-producing causes, and, furthermore, because we are unwilling to have the matter pass into oblivion. We allude to that part of the paper by Dr. Kedzie in which he treats of the disastrous effects of stair-climbing upon the health of females. We would not have this subject forgotten. We would keep it before the people of this State. We would repeat, aye, and re-repeat that the price paid for lofty school-houses, with their upper-story high schools, and their long flights of stairs, is the life-long suffering of not a few who attend the same.

Gentlemen,—school boards,—the price is too much. Build, if you will, your three or four-storied buildings; select some eminence in the edge of your city or village and crown it with an edifice of commanding height, of harmonious proportions, of beautiful finish; run up your long flights of stairs, and finish and furnish it tastily and well; and then, when all is prepared, over the doors and on the walls of that upper story high school room write, not, perhaps, Dante's inscription over the gates of the Inferno, "All hope abandon ye who enter here," but this: "A place for the manufacture of suffering, diseased, and wretched invalids." Were the question submitted to our ablest physicians or our most experienced and best informed educators, there can be little doubt as to what their judgment would be. Is it too much to hope that the day is not far distant when the people of this great State will no longer be blind to their own true interests, and will understand and feel that it is vastly better to sacrifice, if need be, architectural beauty and symmetry, than to purchase them at so fearful a cost as these long years of ill-health, suffering, and pain? May the day of three or four-story school buildings soon pass away, that with them may also pass away the evil consequences for which they are responsible and to which they give rise.

We would then stamp as reprehensible, whatever in our present educational methods has a tendency injuriously to affect, in any of the ways we have mentioned, those subjected to their influences. Believing that the future of the nation rests upon the rising generation, we would that the highest attainable perfection should find place in our system of education. We would have the best methods, carried out in the best way. We would complain so long and so loudly that our complaint shall be heard and attended to; we would complain of every school building, that compels its high-school department to climb two or three long flights of stairs from two to four times a day, and puts its primary scholars in a basement, perchance damp and unwholesome, as though anxious to get the tenderest and the youngest under ground as soon as possible. We would complain of every over-crowded, illy ventilated, half-warmed, and poorly lighted school-room in our State. We would frame a bill of indictment against the makers and putters-in of so much of the school furniture of the day as tends to produce sunken chests, distorted spines, or short-sighted eyes. We would protest most earnestly against every system of school regulations, which, ignoring the plainest requirements of nature, and the clearest teachings of physiology and hygiene, keeps the children during an ordinary school session of three hours with no recess, thus paving the way for diseases whose duration may be life-long; and for suffering, more easily spoken of than endured. We believe that all this can be, and that it should be at once remedied, and that our educational processes should be rid of the evils thus fastened upon them. Nor is this all; we complain of every method which makes what the readiest and most active minds in the class can accomplish, the rule and

measure of the work required, ignoring the fact that the large majority can only reach this measure, if at all, at risk of enfeebled health, if not of life-long suffering.

It will, doubtless, be remembered that the last of the questions addressed by the Massachusetts State Board of Health to its numerous correspondents runs as follows:

“How can our schools be modified to improve their hygienic influences?”

“a. As to tasks and discipline?”

“b. As to physical conditions?”

We have already observed that the answers to this question are various and often conflicting, and have now reached a point in this Report where we are prepared to consider them more at length. Taking the last of the two divisions first, and we find the answers susceptible of the following tabulation:

1. By better ventilation.....	77
2. By more equable heating.....	27
3. By regularity in daily physical exercises.....	21
4. By more frequent change and freedom of position.....	21
5. By better seats and desks.....	17
6. Shorter sessions.....	17
7. Better lighting.....	14
8. More frequent recesses.....	13
9. Fewer pupils to each teacher.....	10

Of these reforms, the first, second, fifth, seventh, and ninth pertain to the school building and its arrangements, and thus come directly within the province of the school boards; while the third, fourth, sixth, and eighth belong chiefly to the superintendent or teacher. We think, then, it may be safe to say, that in this department the great need is, intelligent and thoughtful school boards, and intelligent and thoughtful teachers,—school boards and teachers who know something of the great laws of health, and, especially, the conditions under which alone, the highest possible degree of healthfulness may be attained and preserved. We would have alike in school boards and teachers an ever-present, ever-abiding sense of responsibility in this direction, and would make as our educational motto this, ever and always: a sound mind in a sound body.

With such school boards we should, at least in the future, secure a class of school buildings that should be free from those features which the general testimony of physiologists declares to be objectionable; and with such teachers the physical condition of the schools under their charge, will be as perfect as it is in their power to make it.

With reference to that part of the question which refers to tasks and discipline, the answers may be arranged as follows:

1. By lightening tasks.....	38
2. “ more discrimination on the part of teachers.....	37
3. “ less routine in methods of teaching and reciting.....	33
4. “ lightening discipline.....	25
5. “ more cheerfulness.....	24
6. “ abolishing “marking” for rank.....	16
7. “ pursuing fewer studies.....	14
8. “ more variety of exercises.....	13

On these answers Dr. Winsor comments as follows: “One who carefully

compares the tabulated statements under question 10,"—the one now before us—"with quotations from individual correspondents, and with the numerous statements as well as the quotations under questions '3,' '5,' and '7,' must perceive that it is far more the effects of anxiety and excitement as to standing in the class, in the eyes of teachers, of committees, of audiences on public occasions, etc., which are lamented and dreaded by correspondents, than the effects of genuine *study* without *artificial* stimulants. If in addition to these evils we could rid the schools of unnecessary anxiety as to promotion from class to class and from school to school, we should have eliminated the greater part of the 'worry' which now works far more harm than all other mental causes together." As to the desirableness of such an elimination there can be no question, whether it can be accomplished without at the same time so "removing the incentives to study to such a degree as to very much diminish the value of school instruction and training," is by no means so well established.

In closing this paper there is one point on which a word or two may be due. It may perchance suggest itself to some who read this Report, that we have said very little upon the mental side of the subject. It could not well be otherwise. Looking at the matter as we have done, rather from a physiological than a psychological standpoint, it seemed that to the mental states or conditions, a secondary place must be of necessity assigned. At the same time it must be evident that it will not do to omit all mention of the psychological developments. Holding as we do to the intimate connection which subsists between the mental and the physical,—believing that the most perfect manhood can be reached only in connection with the best and healthiest training of both mental and physical, it will not do to ignore all reference to the mental results accomplished or sought to be accomplished by our systems of education. Already has attention been called to the fact that the highest results of the educational process is to be sought in the direction of a sound mind in a sound body. But are the two compatible? Can they be united in the same person? Is it possible to possess both, or must one be sacrificed ere the other can be reached? Can we have the highest mental culture conjoined with the most perfect physical development? Is it necessary to the highest mental development that it be accompanied by the hollow eyes, sunken chests, weakened nerves, and miserable state generally, that we sometimes see in those who have attained intellectual greatness? Must the mind devour the body ere it can reach the fullest and broadest range of its powers? Are the fires of genius to reach their greatest brightness only as they are fed by the health and life of those in whom they burn so brightly? To these questions, we believe, a negative answer may be given, and that body and mind,—the mental and the physical educated,—trained, developed aright, can grow up into the noblest type of perfect manhood.

NOTE.—Dr. Guillaume also investigated a type of school-room disease to which he gave the name of *Goitre Scolaire* (Scholar's Goitre). Among the boys he found one hundred and sixty-nine cases, or forty-eight per cent., and among the girls two hundred and forty-five cases, or sixty-four per cent. He does not regard this disease as endemic in Neufchâtel, and affirms that it frequently disappears during vacation, but shows itself already in girls of eight years of age, after having attended school for one year. On this particular point the article of Dr. Virchow thus goes on: "As yet, Dr. Guillaume's researches are the only ones made with regard to this disease, and it is a question whether more general investigations would prove the same; it cannot, however, be doubted that females are in early growth predisposed to goitre, and that any apparently slight additional cause may bring about this disease."



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# RESUSCITATION OF THE DROWNED.

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BY R. C. KEDZIE,

*Member of this Board, and Chairman of Committee on Accidents and Special Sources  
of Danger to Health and Life.*

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## RESUSCITATION OF THE DROWNED.

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Loss of life by accidental drowning is unfortunately of frequent occurrence. The large lakes which clasp our border, the many rivers which water our State and the innumerable small lakes and ponds which dot its surface, afford ample opportunity for such accidents. The habits of our citizens sometimes increase this danger. Ice is removed from lakes and rivers to be stored up for use in summer. The exposed water-surface is often left without any guard, and the danger is often covered from sight by drifted snow, and persons are thus left to plunge into this unseen danger. The liability to this accident is greatest in the night, when it is difficult to arouse the attention of persons to render assistance, and the victim is often left in darkness and alone to battle with death from cold and drowning. There is only one county (Ottawa) in this State, where the law compels the erection of a fence or guard around such exposed places. The same legal provision should embrace our whole State. A trifling expense will be incurred, but lives will be saved.

The circumstances attending accidental drowning are often such as to give little promise of successful treatment. The excitement attending such accidents, the fact that the persons who may chance to be present are often without any experience in the treatment of the drowned, or any instruction how to proceed in such an emergency, and that the patient is often far removed from desirable appliances for treatment, are serious obstacles in the way of resuscitation of the drowned. All these considerations render it very important that there should be printed directions how to secure such resuscitation, and that these should be widely distributed through the State. The method should be simple, easily understood, and such as can be carried out on the spot, even by one person, and with such means as are always at hand.

The attention of the State Board of Health was first called to the necessity of issuing a card of instructions by receiving copies of "Rules for the Treatment of the Drowned," prepared by Benjamin Howard, M. D., of New York, and issued by the Life-saving Society of New York. The committee desire to express their great obligation to this society for copies of these valuable rules, and also their high appreciation of the Prize Essay by Dr. Howard, on this subject, published in the Transactions of the American Medical Association for 1871.

The State Board of Health also received the following valuable communication from Dr. Beech, of Coldwater:

*To the Honorable the Board of Health of the State of Michigan:*

Learning that you contemplate publishing in a form convenient for reference, or popular instruction, some condensed rules for resuscitating persons



asphyxiated from drowning or otherwise, I beg leave to present for your consideration a *ready* system, which I caused to be published in January last, and which, so far as I can remember, originated in my own mind somewhat more than one year ago. The wording differs a trifle from my first published rules.

1st. Loosen all neck and waist bands,—*break or cut them, unless they unbutton or unhook readily.*

2d. Turn the patient upon the face, with a small roll, as a cap, a coat, or even a clod of earth, or a stick under the forehead.

3d. Step straddle of the body, looking toward the head; get your fingers into the armholes of the coat by tucking in the sleeves (or into the vest and suspenders; or if the body be naked as in swimming, put a handkerchief or something else around each arm close to the shoulder), lift the body as high as you can and not raise the forehead quite off from its resting place. Hold it up long enough to count one, two, three, about as slow as the old wood clock ticks, then let it down slowly.

4th. Straighten the neck, turning the head a little to one side; press pretty hard, and quickly, upon the ribs of both sides at once.

5th. When you have had time to count ten, at about the clock-tick rate before named, raise the shoulders again in the manner and time described, and keep up these motions for an hour at least; not forgetting as you work on to shout occasionally for help if you are alone. When the body is down see that the mouth is clear, and the neck not cramped or doubled. If the body is naked occasionally slap the fleshy portions, or the cheeks, or rub the limbs, or give the hair of the forehead a smart pull. Occasionally rolling the body gently upon the sides, helps; but do not let it rest upon the back, unless the tongue is kept well forward (for a person nearly drowned, or suffocated, or in a fit, will choke with his own tongue).

6th. Before the patient can swallow, spirits of some kind with water, or warm milk, or coffee may be injected to the bowel, if help enough, and the means are at hand; *but do not let anything interfere with the artificial respiration.*

7th. To restore the warmth of the body is next to breathing in importance. For this use hot dry cloths, warm bricks, stone, sand, or bottles. REMEMBER, that the head should be warmed nearly as fast as the body.<sup>1</sup>

8th. When the patient can surely swallow, warm coffee, broth, milk, or punch should be given in small quantities.

9th. After succeeding so far, wrap the patient warmly, without the fatigue of dressing, and allow perfect rest, with plenty of fresh air.

Pardon the following criticisms of the "Rules of the Life-saving Society of New York." "Rule 1st. To strip the patient to the waist," would be losing time, and worse than useless in allowing the winds to chill or freeze the body; even in summer it is not advisable. Loosening the neck and waist bands is all that is required.

These rules are for those who have no judgment, or are too much excited to exercise it. Hence, "to throw the *weight* forcibly two or three times for a moment or two upon the patient's back," etc., might result in pretty severe treatment, if the patient was of light frame and the operator a robust stevedore or yeoman.

From my observation (which I admit has not been great) I believe that the method which I propose will clear the water from the viscera.

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<sup>1</sup>I nearly lost a little girl patient from apoplectic symptoms, by neglecting the warmth of the head.

"Rule 2," without an assistant to hold the tongue forward would be of doubtful utility. The "count" has no measure for its time. Artificial *breathing* should be performed slower than the natural.

The order to "pin both wrists to the ground" is useless, and liable to be misunderstood. A backwoodsman in trying to obey it, would probably cut two forked sticks and push them into the ground astride the wrists. Again, "brandy and water every five minutes," would soon depress and vomit most patients, and might be harder to get than its superiors, coffee, broth, milk, or whiskey punch.

I agree mainly, but not entirely, with Dr. Howard, in his criticisms of Marshall Hall's and Sylvester's methods (see Prize Essay in Vol. 22, Trans. Amer. Med. Association), and have earnestly desired to test my method upon the cadaver, in comparison with either of the three.

I have numbered the different movements up to nine (9), because I think it the simplest method of directing attention to each step.

Perhaps this is too prolix or verbose, but does not the rehearsal of an occasional reason for an act, prompt reasoning in all of the acts, better than arbitrary rules?

Trusting that this, perhaps too lengthy, communication may not seem impertinent, I respectfully submit it for your consideration.

J. H. BEECH, M. D.

Coldwater, Mich., March 23d, 1874.

#### HOW IS LIFE ARRESTED IN DROWNING?

Dr. Desgranges has pointed out two modes in which death may take place in drowning: the first he calls *syncopal asphyxia*, where the person by reason of fright, or from the sudden immersion in cold water, faints at the time of immersion. In such case life is arrested for a time, but not destroyed. The person may remain as in a trance for a considerable time and yet be capable of restoration to life. In this form of drowning the face usually is remarkably pale, and the countenance has a pinched appearance. Most of the cases where recovery has taken place after prolonged submersion are probably of this class. The second form Desgranges calls *suffocative asphyxia*, where the heart continues to act after respiration is impossible. Unoxygenized blood is forced through the arteries and acts as a sedative poison on the brain and nervous system. In this form of drowning the face is usually bloated and the countenance livid.

Death takes place from privation of oxygen, and not from the water swallowed, or even from water in the air passages, except as this prevents the entrance of air into the lungs.

#### HOW LONG AFTER SUBMERSION BEFORE DEATH IS COMPLETE?

The length of time after submersion before the patient is beyond recovery varies greatly in different cases. In the form of drowning with fainting, the patient may be revived after a submersion of many minutes or even hours. In the suffocative form of drowning life appears to be extinguished much more rapidly.

#### WHEN IS DEATH COMPLETE?

In Taylor's Medical Jurisprudence we find this statement: "After the entire suspension of respiration the action of the heart gradually slackens and finally stops. It is at this period of the complete arrest of circulation that

*asphyxia* passes into death. *Asphyxia* is determined by the period at which respiration is completely arrested; but the point of time at which death from drowning occurs, is fixed by the moment at which the action of the heart ceases."—Vol. II., p. 2.

This dictum would define the limit of life by a sharply defined line, and may be desirable in the precision required in medico-legal practice, but it would be entirely inadmissible in medical practice. A person is dead when the heart will not respond to its physiological stimulus, *e. g.*, the refusal of the left side of the heart to contract when distended with arterial blood. When the heart persistently refuses to respond to this stimulus, death has won the victory. Experiments in the lower animals have shown that life may be so far suspended that the heart has entirely ceased to act, as was shown by opening the pericardium and inspecting the heart; but by artificial respiration the blood began to flow from the engorged lungs, the left side of the heart became distended with blood, and the heart again began to beat. *Life is not extinct so long as the heart is capable of acting under its appropriate stimulus.* The point of arrest is in the lungs rather than in the heart, because the lungs will not freely allow the passage of unoxygenized blood. No amount of heart action will save life or prolong it in the absence of the proper lung action. Our attention must be given to secure the proper lung action, to secure the proper aëration of the blood, and if by this means we can again arouse the heart to action, life may be saved.

#### HOW LONG SHALL EFFORTS TO RESUSCITATE BE CONTINUED?

The length of time during which efforts to restore respiration should be continued, I consider of great importance. We are not to assume that the person is dead merely because he appears to be lifeless. Well authenticated instances are on record where life has been restored even after hours of complete submersion. Still more numerous instances exist in which after short submersion, life has been restored when no appearance of vitality was manifested for a period varying from one to three hours. Those who have given most attention to this subject agree that efforts to restore life should not be abandoned short of two hours.

From accounts I see in the newspapers I am led to believe that very many persons taken from the water, even after submersion of only a few minutes, are given up as dead, or that efforts to restore life are discontinued unless signs of returning life are found in a few minutes. It is not unusual to read accounts substantially like the following: "John ———, aged 10, fell from the dock into the river this morning, and sank in 15 feet of water. He was recovered in five minutes, and policeman Smith conveyed the body to the afflicted parents, at No. 49, ——— street." Usually, no mention is made of any effort to recall life. It may be that energetic efforts to restore life, continued for hours, are so common that the reporter did not think it necessary to chronicle so ordinary an occurrence. But from reading the account one would naturally conclude that it was assumed that the body was dead because it appeared to be so.

#### POLICE DRILL.

The police in many of our lake ports are often called to rescue the drowning, and have the best opportunity to restore those apparently drowned because they are usually the first to reach the victim. Efforts to revive the

drowned will be hopeful in proportion to the earliness with which such efforts are made. In New York and other seaport cities, the police are thoroughly drilled in the manipulation required for such treatment. It is very desirable that the police in our lake ports should be drilled in like manner, that they may render efficient and timely aid when opportunity offers.

#### METHOD OF RESUSCITATION.

The following method of treatment of the drowned has been issued in form of a card, for general distribution in the State. The card is issued in two forms, one on flexible paper, of small size, such as can be carried in the vest pocket; the other on Bristol board, of large size, suitable for fastening to the wall.

The directions embraced in this card have been drawn from various sources,—from Dr. Beech's valuable communication, from the "Rules of the Life-saving Society of New York," and from other sources.

The committee desire to acknowledge the great assistance they have received from Dr. Beech, and from the Prize Essay of Dr. Howard.

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### THE TREATMENT OF THE DROWNED.

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THE TWO THINGS TO BE DONE:—RESTORE BREATHING; RESTORE ANIMAL HEAT.

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**RULE 1. Remove all obstructions to breathing.** INSTANTLY loosen or cut apart all neck and waist bands; turn the patient on his face with the head down hill; stand astride the hips with your face towards his head, and locking your fingers together under his belly, raise the body as high as you can without lifting the forehead off the ground (Fig. 1.), and give the body a smart jerk to remove mucus from the throat and water from the windpipe; hold the body suspended long enough to slowly count ONE-TWO-THREE-FOUR-FIVE—repeating the jerk more gently two or three times.





**RULE 2.** Place the patient on the ground, face downward, and, maintaining all the while your position astride the body, grasp the points of the shoulders by the clothing, or if the body is naked, thrust your fingers into the armpits, clasping your thumbs over the points of the shoulders, and **raise the chest as high as you can** (Fig. 2.) without lifting the head quite off the ground, and hold it long enough to *slowly* count **ONE-TWO-THREE**. Replace him on

the ground with his forehead on his flexed arm, the neck straightened out and the mouth and nose free; place your elbows against your knees and your hands upon the sides of his chest (Fig. 3.) **over the lower ribs and press downward and inward with increasing force** long enough to slowly count **ONE-TWO**. Then suddenly let go, grasp the shoulders as before, and raise the chest (Fig. 2.); then press upon the ribs, etc. (Fig. 3.) These alternate movements should be repeated ten or fifteen times a minute for an hour at least, unless breathing is restored sooner. Use the same regularity as in natural breathing.



**RULE 3.** After breathing has commenced, **RESTORE THE ANIMAL HEAT**. Wrap him in warm blankets, apply bottles of hot water, hot bricks, or anything to restore heat. *Warm the head nearly as fast as the body, lest convulsions come on.* Rubbing the body with warm cloths or the hand, and slapping the fleshy parts may assist to restore warmth and the breathing also.

If the patient can **SURELY** swallow, give hot coffee, tea, milk, or a little hot sling. Give spirits sparingly, lest they produce depression.

Place the patient in a warm bed, and give him plenty of fresh air. Keep him quiet.

### BEWARE!

**AVOID DELAY.** A MOMENT may turn the scale for life or death. Dry ground, shelter, warmth, stimulants, etc., at this moment are nothing—**ARTIFICIAL BREATHING IS EVERYTHING**—is the **ONE REMEDY**—all others are secondary. **Do not stop to remove wet clothing.** Precious time is wasted, and the patient may be fatally chilled by exposure of the naked body, even in summer. Give all your attention and effort to restore breathing by forcing air into, and out of, the lungs. If the breathing has just ceased, a smart slap on the face or a vigorous twist of the hair will sometimes start it again, and may be tried

incidentally. Before natural breathing is fully restored, do not let the patient lie on his back unless some person holds the tongue forward. The tongue by falling back may close the windpipe and cause fatal choking.

**Prevent friends from crowding around the patient and excluding fresh air**; also from trying to give stimulants before the patient can swallow; the first causes suffocation, the second fatal choking.

**DO NOT GIVE UP TOO SOON**; you are working for life. Any time within two hours you may be on the very threshold of success without there being any sign of it.

**In suffocation by smoke or any poisonous gas**, as also by hanging, proceed the same as for drowning, omitting effort to expel water, etc., from windpipe.

**In suspended breathing from effects of Chloroform, Hydrate of Chloral, etc.**, proceed by Rule 2, taking especial pains to **keep the head very low**, and preventing closure of the windpipe by the tongue falling back

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These rules are of a purpose drawn up in the plainest and simplest words so that any person may understand them and be able to put them in practice. They are such as can be carried out at once and upon the spot, by one or two persons, and with such appliances as are always at hand. To spend time to send to a distance for better appliances or for medical assistance while nothing is done to revive the patient, is only to jeopardize if not waste life. To get the doctor; to have warm blankets and stimulants, to place the patient in a warm room, etc., may be very desirable, but nothing should interfere with or delay for a moment the immediate employment of means to restore respiration, impart warmth to the chilled and dying body, and to rouse the vital forces to their normal action. If we can get the patient to breathe, we have good hopes that he will live; without this there is no hope. For this reason every effort should be directed to restore the breathing; dry ground, dry clothing, warmth, and stimulants are of no moment compared with restoring the respiration.

The direction to strip the patient of his wet clothes seems a very natural one, but it is often unnecessary, and sometimes a decided injury. It is objected that the wet clothes, by their evaporation, will reduce the temperature; but we must remember that the body too is wet, and evaporation will reduce its temperature still farther, and that the winds blowing over the chilled body will increase the evil still more. If the wet clothes could be replaced by dry ones, good would be secured, but the delay in efforts to restore respiration might be a greater evil than wet clothing. Besides the clothes are of great assistance in giving us the means to grasp and manipulate the body.

The direction given to place the patient on his back, in restoring respiration, is opposed by anatomical considerations, unless there is another person present to hold forward the tongue, and unless he performs this task successfully. The tongue falling back may close the glottis successfully against all entrance of the air. Persons overcome by narcotic poison or by foul air who choke to death by this action of the tongue while lying on the back, who might recover if placed with the face downward.

#### THE THINGS TO BE DONE.

The restoration of the respiration is first in importance; the restoration of animal heat is of secondary importance, because the quickest way to restore

animal heat is to revive the circulation by aerating the blood,—a prime condition of its circulation. Unoxygenized blood will not freely pass through the lungs, and hence the engorged condition of the right side of the heart and the pulmonary arteries in death by suffocation. Oxygenize this blood and it will pass on to the left side of the heart, and by filling its cavity and thus supplying the normal stimulus to that organ, contraction will take place if vital irritability is not destroyed.

Animal heat is maintained by the chemical changes attending the circulation of the blood. It is *the way* to restore animal heat. The human body is an exceedingly poor conductor of heat. Those who have tried to warm the body in the deadly chill of Cholera, or of Pernicious fever, by external applications, have found how powerless they are for such purposes. The best way to warm a stove is not to wrap it in a warm blanket, but to *kindle a fire within it*. It is true that a non-conducting envelope surrounding the stove and thus preventing loss of heat by radiation, will secure greater warmth from a limited amount of fire, and in like manner in warming the drowned body, dry blankets will secure better results than wet clothing or exposure of the naked body.

While restoration of animal heat is of great importance, we should let it occupy a secondary position in our efforts, because by securing respiration we at the same time avail ourselves of the natural and most efficient method of warming the body.

By unloading the engorged lungs by aerating the blood, and by promoting its flow to the left side of the heart, we oppose resistance at the very door by which death is entering; by establishing this process of aeration of the blood, we close the door and bolt it in his face. Without internal assistance by the chemical changes secured by oxygenized blood, no amount of external heat will warm the internal viscera and start into motion the idle wheels of life. The external warmth is of great importance; the internal sources of heat are a vital necessity.

When we attempt to apply external warmth, the means employed should be as efficient as we may command. No such cautious restoration of warmth as is required in treating a frost-bitten member is allowable. The body is chilled, not frozen. A striking instance of misdirected caution is given in the American Journal of Medical Sciences for 1867, where a patient taken apparently dead from the waters of Regent's Park, was treated for a time by rubbing the chest and limbs with ice and snow. The patient recovered in spite of this branch of his treatment.

#### THE WARM BATH USUALLY NEEDLESS.

Before respiration is fully established, the warm bath is objectionable, because it only tends to secure warmth, and interferes with efforts at establishing respiration. In fact, a certain amount of respiration takes place through the skin itself, which would be prevented by the bath. This cutaneous respiration is shown by the fact that the skin of the drowned often loses its livid appearance and becomes rosy as in perfect health, even when life is extinguished. When respiration is established, the warm bath is usually unnecessary.

When there is sufficient help present to use means to restore animal heat without omitting or relaxing the efforts to restore respiration, both processes should be carried on together. The lower extremities should be stripped of wet clothes and wrapped in warm and dry blankets or the coats of the assistants, and hot bricks, and other heating materials applied freely. Friction, by

rubbing the surface with dry cloths or the naked hand, should be used energetically and constantly till warmth and the circulation are well restored.

KEEP THE HEAD LOW.

The great majority of recoverable cases of drowning after prolonged submersion, probably belong to the syncopal form (attended by fainting). The brain ceases to act from deficiency of blood; this can best be remedied by keeping the head low so that blood may gravitate to the brain in sufficient quantity to arouse it to action. The remarkable success attending Nelaton's method of treatment for narcosis by Chloroform (viz.: by inverting the body, drawing the tongue forward with a tenaculum, and employing artificial respiration) suggests the propriety of resorting to similar treatment in drowning. In the old method of treating the drowned, the patient was hung up by the heels, or laid across a barrel with his head hanging down to let the water run out of his lungs. This practice was condemned because the reason assigned for it was not satisfactory; but the question arises whether the practice was discontinued because of the unsatisfactory results, or on account of the insufficient reason given for its use. If we employ a good method in any case, but give a poor explanation of its mode of action, the success of our treatment will not be limited by the insufficiency of our explanation of its mode of action. While it may not be desirable to hang a person up by the heels, it is very desirable to keep the head low to assist in the recovery from faintness which may itself become fatal.





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SANITARY INSPECTION  
OF  
CERTAIN STATE INSTITUTIONS.

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BY R. C. KEDZIE,

CHAIRMAN OF COMMITTEE ON VENTILATION, Etc.

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## SANITARY INSPECTION OF CERTAIN STATE INSTITUTIONS.

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Last November I received the following communication :

LANSING, *November 14, 1874.*

PROF. R. C. KEDZIE :

DEAR SIR,—The Board of Commissioners for the Supervision of Penal, Pauper, and Charitable Institutions has instructed me to request you to visit the State Prison at Jackson, the Reform School at Lansing, the Detroit House of Correction, the State Public School at Coldwater, and the State Institution for the Deaf and Dumb and the Blind at Flint, at the earliest practicable period, and examine into the ventilation and sanitary conditions of the several buildings occupied and used by the inmates of said institutions. The Board desire you to make a full examination and report the result thereof, with such suggestions for improvement as you may think desirable, to me, at your earliest convenience. When you have completed the work, please make out your charge for expenses, and the same will be allowed by the Board.

Yours very truly,

C. M. CROSWELL, *Secretary.*

In accordance with this request, I visited the several institutions named, and made my report to the Secretary of that Board.

At the January meeting of the State Board of Health, when the several committees were called for reports of the work performed by the committees for the quarter, when Committee No. 4 (on ventilation, etc.) was called, I reported the work I had done for the Board of Commissioners for Penal, etc., Institutions. By vote of the Board of Health, I was directed to prepare a report of these investigations for insertion in the Report of the Secretary of this Board.

### STATE PUBLIC SCHOOL AT COLDWATER.

#### *Water Supply.*

I found there were three sources for the water supply: rain water, water from a well near the buildings, and from another well some thirty rods west of the buildings. I found nothing objectionable in the methods of gathering and storing the rain water. The water in the wells does not appear to be contaminated at present. I examined the water from one well some months ago, at the request of Prof. Truesdell, and found it of good quality, but the conditions for somewhat speedy and effectual contamination of this water already exist. A privy with four seats, and a deep vault or cesspool to receive the excreta, is placed within three rods of this well. This privy is in general use. All that stands between the well and this abundant and loathsome form of contamination is three rods of earth. The power of the soil to absorb and retain excremental matter is limited, and when once this limit is reached, fecal contamination of this water appears to be inevitable.

This privy should be removed at once, the vault thoroughly cleaned and purified, and filled up with fresh soil; the water should be inspected from time to time to detect any contamination. I am informed that the officers of the school have very properly forbidden the use of this water for drinking or for culinary use.

The well west of the buildings I consider to be exposed to the same danger. This well is twenty-five feet deep, and the subsoil in which the well is sunk is a coarse gravel,—a soil through which liquid matter will pass very rapidly, and which has the feeblest absorptive and retentive power for excremental matter. Fifteen rods northwest of this well is the main cesspool for the whole establishment. Into this cesspool, which appears to be about fifteen feet deep, all the waste water of the school is carried, including the water from the wash-room, kitchen, sinks, etc. The water in the main sewer also receives all the sewage from the water closets in the principal building, and passes through the vault of one privy. In other words, this principal sewer conveys all the sewage of the entire establishment except that from the privies for the children, in the rear of the cottages, and the one near the other well, and pours this accumulated filth into a hole in a gravelly soil near the principal well. About eighty barrels a day of sewage are thus deposited in this porous stratum, only fifteen rods from the well from which are pumped about one hundred barrels daily for the use of the school.

The position of the cesspool was defended because "the underground drainage of the whole basin is *to the west*, and hence the sewage would *flow away from the well*, and no contamination of the water would be possible." But, so far as I can learn, this westward flow of underground currents at Coldwater is an unproven hypothesis; and when I find that the cesspool is only seven or eight rods west of the well, I feel that this hypothesis of strong westerly currents, with only eight rods start in the flow of the sewage, is too slender a thread on which to hang the lives and health of eight score of helpless orphans. This is not merely a question of good taste and cleanliness, even though every one revolts at the idea of such possible contamination, but life and health are at stake. The well established connection between sewage contamination and typhoid fever should awaken the gravest fears of future evil if this condition of things should continue. That no such rapid escape of this sewage "to the west" does actually take place was evident from the fact the cesspool, at the time I saw it, was nearly half full of foul and offensive sewage matter. The water in this well may not now be contaminated, but how long may we safely assume that this condition will continue?

#### *Privies.*

The privy system in use for the scholars is all wrong. It is the old barbarism of a blind well in the ground. Although in use but a short time, these privies all pour out offensive gases to foul the air, and they are at all times loading the soil with the seeds of death. This condition is not the result of neglect, for efforts have been made to correct the foster, but it is the natural result of the system.

These vaults should all be thoroughly cleaned and filled with fresh earth and some form of the dry earth system used in place of the vaults. The owner of the hop-field in rear of the school could well afford to be at all the expense of removing this manural matter which that crop so largely demands; but, at any outlay of expense, the present vault system should be replaced by something better.

*Under-floor Space.*

The space under the first floors of the cottages is in an unwholesome condition from want of ventilation. Two small spaces, 5x12 inches, in the west wall, and the same in the east wall, are all the provisions made for ventilating this space. I found the ground under the floor damp, the air musty, and the boards spotted with mould. I was induced to examine this space carefully because there has been so much diphtheria in the school the past season. These small ventilating holes should be replaced by grated windows, at least 15x30 inches, and these kept open whenever there is not imminent danger of the steam pipes freezing.

*Ventilation.*

The ventilation of all these buildings is not satisfactory, but is singularly defective. I can compare it to nothing but *shears with only one blade*. While there is inadequate provision made for the escape of foul air, *there is no provision for the entrance of pure air*. In all the buildings, from the Principal's Hall to the Orphans' Cottage, not a single fresh air duct could be found. Of what possible use the architect considered the educt flues when there are no inlet flues, passes my comprehension. The plainest common sense should teach any man that air can leave a closed room only as a corresponding volume of air enters the room. "Nature abhors a vacuum," and sanitary science "abhors" ventilation that does not ventilate. These considerations bear with especial force on the cottages, from their overcrowded condition. The dimensions of the dormitories are 14x27x9½ feet. These dormitories contain fourteen persons each—some of them sixteen.

This would give 256 cubic feet to a person. The smallest cubic space for an adult allowed by standard authorities is 600 feet. It is conceded that a small boy will not require as much cubic space as an adult man, but when we consider how much more rapid is the respiration of a boy, and the change of tissue, than in a man, we see that the amount of space cannot be very materially reduced with safety. But even if we reduce the allowed space to one-half and subtract the space occupied by the beds, etc., we find that these dormitories could safely contain only ten boys each, and this would require most perfect ventilation. Yet the opening into the ventilating shaft is only 9x12 inches, and the shaft itself much smaller, while there is no provision for bringing in fresh air except by opening a window.

It may be objected that these views in regard to the defective ventilation and consequent contamination of air in the cottages, are merely the conjectures of an individual. I do not propose to leave it to the conjecture of any one, but base my opinion on the chemical analysis of the air taken from a number of these cottages. Pure air of the country contains about four parts of carbonic acid in ten thousand of air. The limit assigned by the best sanitarians to *air contaminated by respiration* is six parts of carbonic acid in ten thousand of air. It must be borne in mind that the carbonic acid is not the only injurious material thrown off in respiration. Air which contains more than the above amount of carbonic acid, but not derived from respiration, may be breathed without injurious effects. Sanitarians merely take the volume of carbonic acid present as a measure of the total contamination by respiration.

In this report, when the volume of carbonic acid is given as a measure of

this contamination of the air by respiration, it will always represent the volume of this gas contained in ten thousand of air.

*Air in the Sitting-Rooms of the Cottages.*

I gathered air from the sitting-rooms of two cottages with the following results: Air from sitting-room of Cottage No. 4, gathered in the evening, twenty-six boys present; two gas jets burning; room warmed by steam radiator; grate partially open but no fire burning; hall door wide open; results, 10.2 parts of carbonic acid. Cottage No. 2, same conditions as in No. 4, except only thirteen boys present; results, 9 parts of carbonic acid. No provision for ventilation in any of these sitting-rooms except by the grate.

*Air in the Dormitories.*

I also gathered air from four of the dormitories at 5 o'clock A. M., before the boys had left their beds. In all the dormitories examined the hall door and the ventilator had been open all night. Dormitory of Cottage No. 1 contained fourteen small boys; one window half open; the air had a close smell, and contained 16 parts of carbonic acid.

No. 2 contained sixteen boys; two windows partially open; air contained 16 parts of carbonic acid.

No. 4 contained fourteen boys; air close, and contained 12.6 parts of carbonic acid.

No. 6 contained fourteen boys; two windows half open; air contained 11 parts of carbonic acid.

No commentary is needed on any system of ventilation which gives such results under the most favorable circumstances.

*Changes in Ventilation Recommended.*

1st. Provide for the admission of pure air, properly warmed. The admission of cold air in strong draughts into occupied rooms by opening windows is not to be tolerated in cold weather, because it is a fruitful source of colds, croup, etc. By cutting a suitably large hole in the wall under the floor, and then cutting away the floor under the radiator, a fresh air flue may be inserted by which an adequate supply of pure air may be introduced into every room. By placing a valve in this flue the supply of fresh air may be regulated, excluding any excess of cold air during high winds. The fresh air may be confined in the vicinity of the radiator, as it ascends, by a metallic screen enclosing the radiator on three sides and for half its height. In this way the air will become so far warmed as to prevent any sense of a cold draught in the room. This arrangement should be provided for every radiator in the buildings, but especially in the cottages, on account of their crowded condition.

2d. The dormitories should at once be provided with some adequate means of ventilation. A large flue (5x3 feet) should be carried from the vacant space at the south end of the hall on the second floor (next to the closet) up through the roof, terminating in a louvre or Emerson's ejector. This will afford a ventilating shaft 5x3 feet and about eighteen feet high. Divide this shaft in the centre by a vertical diaphragm, and there will be two shafts, each 3x2½ feet, one next to each dormitory. Place a large ventilating screen 24x30 inches near the bottom of each flue, opening into the dormitory, and place a coil of steam pipe in each shaft to adequately warm the air and thus cause an ascensional current of air. If the fresh air flues in both

sitting-rooms below are open, the grates closed, and all the hall doors open, there will be secured such ventilation as will keep these rooms in a safe condition for dormitory purposes. This should be the arrangement for the night.\*

I have been very specific on this matter of ventilation, because the evil must be corrected speedily before the advent of very cold weather if we would avoid results which all would deplore.

#### STATE PRISON.

In making a sanitary inspection of the State Prison, I first directed my attention to the ventilation of the cells. The cells in both wings of the prison are built in double rows, the cells abutting end to end, and the division wall between these sets of cells, contains the flues for ventilating the cells. The cells in the 1st, 2d, and 3d tiers, in both wings, had small openings into these flues for purposes of ventilation, but on careful examination, no air was found to pass through any of these openings. The flame of a burning match held in these openings was as undisturbed by motion of air as if corked up in a bottle. Wishing to find the cause of this, I obtained entrance into the attic of the west wing, when I found the ventilating flues were all completely obstructed by a thick plate resting on the top of the wall throughout its whole length, this plate serving to sustain the centre of the roof of the wing. The air in the ventilating shafts had not sufficient force to penetrate a plate six inches thick, and then pierce the gravel roof! I could not gain access to the attic of the east wing, but ascended to the roof, where I found two boxes rising above the level of the roof. These boxes were about 30 inches long and six wide; a board was nailed over the top of the box, but the side pieces lacked two inches of reaching this cap piece. Thus a crevice, 2 inches wide and 30 inches long was left on each side of these two boxes through which air might pass. On tearing off the cap-piece, I could look down into the attic and see the tops of the ventilating shafts in the wall separating the north and south sets of cells. These shafts were 4 x 8 inches, and each shaft should ventilate eight cells; but unfortunately, they all terminate in a garret which is air-tight, except the small cracks in the two boxes already described. Practically, there was a gimlet-hole to ventilate a cell in which a man is confined about 13 hours of each day!

#### *Air in the Cells.*

At 6 o'clock A. M., before the men had left their beds, I gathered specimens of air from four cells, widely separated from each other. The guards informed me that when the men all march out from their cells in the morning, each carrying his night-bucket, the halls are filled with an overpowering odor. The air in every cell examined was loathsome and disgusting in the extreme. Analysis of this air gave the following results:

No. 69—1st tier, east wing, contained 21.9 parts of carbonic acid.

No. 11—3d tier, east wing, contained 22.5 parts of carbonic acid.

No. 64—3d tier, east wing, contained 22.5 parts of carbonic acid.

Cell on 3d tier, west wing, contained 22 parts of carbonic acid.

No comments required!

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\* Since the above was written I have received a note from Prof. Truesdell, bearing date of January 23, in which he says: "During this month we have kept up steam at night as well as during the day. By opening the windows opposite the radiators we have been able to keep the dormitories in good condition. The air smells sweet in the morning."

This shows the earnest efforts of Prof. Truesdell to make the best of a bad arrangement. Such efforts are worthy of all praise.



*Hospital.*

The hospital is an old building, and is not fit for use as a hospital. New and better quarters will soon be occupied. The air in the hospital was below the healthy standard, containing 12.65 parts of carbonic acid.

*Work Shops.*

The work shops are either without any system of ventilation, or are very imperfectly ventilated. The wagon shop, about which there is great complaint, has two ventilating shafts, but the draft is often downward, and at other times they discharge the foul air only very imperfectly. If a "blower," such as is used in the forges of this shop, were placed in the throat of each shaft, better results would be secured; and if there were six ventilating shafts instead of two, still better results. The air in the wagon shop contained 15.2 parts of carbonic acid.

In the cigar shop no attempt at ventilation was visible. The hoisting gangway might be made to do duty in ventilation by carrying the shaft above the roof and terminating in a louver. The air in this shop contained 14.6 parts of carbonic acid.

When I entered the trip-hammer shop of Withington, Cooley & Co., I thought I should strangle from the fumes arising from some twenty open coke fires, which pour their gaseous products at once into the room, but after staying a short time the lungs became more accustomed to the poison. An officer of the prison told me that several men had been carried from a certain place in this shop in an insensible condition. An inspector of the prison told me that I was certainly misinformed on this point. I immediately wrote to the prison agent to inform me if I was misinformed on this point, but I have received no reply. These open coke fires should all be covered with a sheet-iron hood with a vertical pipe to carry off the products of combustion. The air in this shop contained 23.54 parts of carbonic acid. How much carbonic oxide it contained I did not determine.

*Privy System.*

Each cell is provided with a wooden bucket and cover. An attempt is made to disinfect and deodorize the buckets by placing a handful of pulverized copperas in each bucket once in two weeks. The bucket is carried out by the convict in the morning to a certain place in the yard where it is emptied and rinsed, and is then ready to be carried at night to the cell.

The bucket system is not a success at the prison. The buckets, after being emptied and rinsed, are still very offensive. The copperas placed in the bucket at such distant intervals of time fails to remove the urinous odor. The copperas either dissolves long before the two weeks expire, or else, reacting with the phosphates in the urine, forms an insoluble crust of phosphate of iron, preventing any further chemical action. I do not think that a wooden bucket can be successfully used for this purpose. The urine soaks into the wood so that no system of rinsing can effectually remove it; it there undergoes chemical changes and constantly evolves ammoniacal compounds, so that the corridors are filled with stench alike when the men carry them out in the morning or bring them back clean (?) at night.

I recommend that metallic buckets and covers of some kind be substituted in place of the wooden buckets. Copper buckets would probably be cheaper in the long run than any other metal, because it will not rust. A half pint of

strong solution of copperas should be poured daily into each bucket after it has been emptied and cleaned. This will relieve the cells of the pungent ammoniacal smell they now possess, and rid the corridors and a portion of the prison yard of a detestable odor.

#### *Sewerage.*

The sewers should be extended so as to drain the space beneath the shops. The under-floor space of most of the shops is damp, and at times, water stands in pools beneath the floor. This is particularly the case in the cabinet shop. This space contains a large amount of decaying sawdust, shavings, etc. The lower portion of this collection is so wet now, that water may be squeezed out of it like a wet sponge. These areas should be thoroughly drained, and ventilated by numerous side windows.

#### *Water Supply.*

The agent of the prison has wisely excluded the water furnished by the Holly water works of Jackson. This water contains too much decaying organic matter to be safely used for drinking purposes or culinary use. The water in use is derived from an artesian well on the premises. I have analyzed this water, and find it contains 45 grains of solid matter in the imperial gallon consisting of:

	Grains.
Carbonate of lime.....	16.51
Sulphate of lime.....	4.50
Carbonate of magnesia.....	7.25
Chlorides of sodium and potassium.....	13.25
Silica.....	1.50
Oxide of iron.....	1.00
Loss.....	99
	<hr/> 45.00

This water would be objectionable for persons disposed to renal difficulties and calculus, but is, perhaps, as good as we may reasonably expect in the geological formation from which it is derived.

#### HOUSE OF CORRECTION.

The ventilation in the shops of the House of Correction is entirely by opening windows. The chair shops look so large and airy that the officers thought there was no use of introducing any system of ventilation. I visited the shops during the gale of Monday, Nov. 23, when the undesigned ventilation by air sifting in by every crack and crevice would be more than usually active, yet the air gathered in the shops was in every instance below the healthy standard.

#### *Shop Ventilation.*

The chair shops had each one window half open; in the other shops the windows were all closed. The air was gathered a short time before the close of the day's work:

Chair shop No. 2, one window half open; 81 men at work; the air contained 17.4 parts of carbonic acid.

Shop occupied by female convicts, engaged in making cane seats; 67 women present; air had a foul smell, and contained 18.5 parts of carbonic acid.

Paint shop; 57 men at work; air contained 12 parts of carbonic acid.

Shoe shop; 48 men at work, in a low room; air had a close and musty smell, and contained 16.4 parts of carbonic acid.

These shops should be provided with large ventilating shafts passing some distance above the roof, and provided with steam coils or some means of securing heat in the shaft to insure a strong ascending current of air at all times. This is emphatically true of the shoe shop and the room occupied by the female convicts, because the rooms are low and the cubic space small as compared with the floor space.

#### *Ventilation of the Cells.*

The cells have no ventilation worthy of the name. In the wing which contains the largest number of cells, the out-door air can only enter by opened windows, which, in cold weather, will make the halls uncomfortable for the guards, who will very naturally close the windows to keep themselves warm. The air can enter the cells only by the grated door, which also serves as the only available means of ventilation. Many of the cells have a small opening into a ventilating shaft in the wall which separates the two systems of cells. This opening is often obstructed with various kinds of rubbish. But when it is open, it is frequently difficult to detect any motion of air in the shaft. A match will often burn tranquilly in the opening, the flame not being swayed in either direction. With some difficulty, I obtained access to the top of these ventilating shafts, when I found that they all terminate in an attic, from which the air can escape only by three ventilating ducts, some 15 inches in diameter, placed in the crest of the roof.

In the north wing, I was not able to detect the least motion of air in the ventilator of any cell, though I examined a large number with great care. I could not gain access to the top of these ventilating shafts to ascertain the cause of the obstruction, but was told by an employé of the house that the shafts terminate in a low horizontal gallery, which is supposed to terminate in a chimney.

#### *Air in the Cells.*

I gathered air from a number of the cells early in the morning before the convicts had left their cells. Analysis of the air gave the following results:

No. 54—1st gallery, one man; air contained 16.72 parts of carbonic acid.

No. 40—flagging, one man; air contained 13.75 parts of carbonic acid.

No. 151—3d gallery, two men; air contained 22.84 parts of carbonic acid.

No. 107—2d gallery, two men; air contained 18.60 parts of carbonic acid.

No. 26—1st gallery, north hall, one man; air contained 13.75 parts of carbonic acid.

No. 67—3d gallery, north hall, two men; air contained 19.50 parts of carbonic acid.

The air in all these cells had a very repulsive odor.

#### *Remedial Measures.*

The ventilating flues should be cleared of all obstructions, and a daily inspection should be made to secure their unobstructed condition. The ventilators in the crest of the roof over the principal range of cells should be increased in size and number, and some means adopted to secure a free ingress of fresh air into the corridors at all times. The ventilating shafts for the cells cannot be increased in size without rebuilding the cells.

In the north hall, the hospital, which occupies a position over the range of

cells, should be removed to some better quarters, and its place should be used for an additional tier of cells, which are very much needed, and then the present no-ventilation of this mass of cells could be replaced by ventilators through which air can pass; the low-vaulted corridors could then be replaced by large ventilators which would carry off the foul air, to some extent at least.

*The Bucket System.*

The cells are provided with wooden buckets for night use. The same objections apply to these as to those in use at the State Prison. They absorb the urine and are foul and offensive at all times. They are emptied in the morning and rinsed with water; a small quantity of caustic lime is added, and they are then covered and returned to the cell before evening. The lime promotes the formation of ammonia, which is mostly retained by the closed bucket, to escape into the air of the cell when opened. I would recommend metallic buckets, and that these should be deodorized by copperas after they have been properly cleansed in the morning.

*Water Supply.*

Water is derived from the Detroit water-works, and is undoubtedly of unobjectionable quality.

INSTITUTION FOR THE DEAF AND DUMB AND THE BLIND.

*Ventilation.*

The ventilation in this institution is on the *plenum* plan, viz: forcing a large quantity of air into the building by a large fan driven by a steam engine, and allowing the excess of air to escape by ventilating shafts. It would seem that direct control over all the movements of air must be secured by this mechanical method, but it is not a complete success. The air is driven by the fan into a long brick gallery, at the entrance of which are massed the steam coils to warm the whole building. To carry such a mass of heated air for a long distance is necessarily attended by a large loss of heat, and the distribution of the heat to all the rooms, especially when high winds prevail, is nearly impossible. If the present apparatus for driving the air were still employed, and the steam coils, instead of being massed in one place, were distributed through the building so as to warm the air where it enters the different rooms, a great economy of fuel might be effected, and the proper temperature in the rooms more certainly secured. Hot air carried through long brick galleries is subject to great loss of temperature in its passage, and this loss cannot be avoided with the present system of warming.

With the practical results as regards ventilation, I was greatly disappointed. I had supposed, with such complete control as the mechanical apparatus in use would afford, that perfect ventilation would certainly be secured. The results actually secured are quite the reverse.

In all the building, the warm air is forced into the rooms by an opening in the wall near the floor, and the ventilators are placed near the top of the room. The natural result is, that the warm air passes rapidly to the top of the room and escapes by the ventilators, leaving a body of cold and impure air in a nearly stagnant condition where the children stay. Like the priest and the Levite, the fresh and warm air "passes by on the other side." It is certain that the heating and ventilating apparatus in use secures an astonishing degree of impurity of the air in the occupied portions of the school-rooms.

*Air in School-rooms.*

No. 11.—Pupils present 14; air contains 12.3 parts of carbonic acid.

No. 16.—Pupils present 16; a window partly open; air contains 17.53 parts of carbonic acid.

No. 18.—Pupils present 14; air contains 23.71 parts of carbonic acid.

No. 14.—Pupils present 16; air contains 12.52 parts of carbonic acid.

That the air in these rooms was in about its usual condition was manifest from the fact that the teachers were astonished when informed of the amount of impurity present in the air of their respective school-rooms.

*Changes Recommended.*

The ventilators should be brought down to the floor level, and made of larger size. Those now in use are about 9 x 9 inches. The transoms over the doors leading from the halls to the school-rooms are stationary. If they were hung on pivots, some ventilation from the hall would be secured.

*Dormitories.*

Ninety-three deaf mutes (males) sleep in one room, occupying 71 beds. The female deaf mutes (71) occupy a similar room. Twenty blind pupils (males) occupy a similar but smaller room, and the same number of blind girls occupy a similar room. The ventilation in all these dormitories is on the same plan as that for the school-rooms, and the results are similar. The decency of having 93 boys and young men occupy one bed-room is not a question that comes within my special field of inquiry. It has been proposed to divide this large room into a number of smaller compartments by half walls. While this will afford some distant approach to isolation, it will greatly exaggerate, in some parts of the room, the present evils of inadequate ventilation.

*Air in the Dormitories.*

The air for analysis was gathered in the dormitories early in the morning, before the pupils had left their beds. The specimens of air from the dormitories of the males were gathered by myself in my usual manner, viz: by repeatedly exhausting the air from the bottle used, by deep inspirations through a long flexible tube, the air from the room flowing into the bottle and taking the place of that which I had inspired. As it was undesirable that a man should enter the sleeping-room of the females, I placed a bottle, filled with water, in the hands of each of the teachers, who had charge of the dormitories for the females, with directions to slowly pour out the water in the morning, when the air of the room would replace the water. But the air thus bubbling up through the water would unquestionably be washed of some of its impurities, and would thus give too low results on analysis. Notwithstanding this objection, this plan was adopted as the best under the circumstances.

Air from dormitory of 93 deaf mutes, contained 14.13 parts of carbonic acid.

Air from dormitory of 20 blind boys, contained 13.40 parts of carbonic acid.

Air from dormitory of 71 deaf mutes (females), contained 13.36 parts of carbonic acid.

Air from dormitory of 20 blind girls, contained 12.20 parts of carbonic acid.

A large proportion of the deaf and the blind are in this condition from scrofula or other constitutional taint. To confine persons thus weakened in

constitution in dormitories as poorly ventilated as the above results show, is very reprehensible.

#### *Remedies.*

If the present dormitories are continued, a large ventilating shaft, at least three feet in diameter, should be inserted in the ceiling of each of the dormitories for the deaf mutes, and carried directly through the dome and terminate in a large ventilating cowl or a louvre. The shaft should be heated with a steam coil to insure a constant upward draft.

This kind of ventilation could not be introduced into the dormitories of the blind. In these the present ventilating flues should be carried down to the floor, and larger ventilators introduced in the place of the small ones now in use.

#### *Privies.*

The accommodations in the building for this necessity are on too limited a scale so far as the pupils are concerned. Think of one night-seat for the use of ninety-three persons, and another for seventy-one! The accommodations for the school-rooms are on the same scale. New and adequate privy accommodations in connection with the dormitories and school-rooms are the demand both of necessity and decency. The architectural arrangement which affords six water-closets for eight or ten teachers, and only the same number for two hundred pupils, is open to criticism.

#### *Water Supply.*

The water for the institution, except for sewer purposes, is derived from a well under the kitchen. Great complaint is made in regard to the quality of this water. A dead rat having been drawn up in a bucket of water, it was determined to clean out the well, which was done the day before I arrived. I was therefore unable to obtain a specimen of the water for analysis. The air in the well had a repulsive smell. From the cellar bottom up to the kitchen floor the well-wall is a light curbing of wood, and I discovered abundant space for the entrance of vermin. This wooden curbing should be replaced by a brick wall laid in mortar, so as to prevent all possible entrance of vermin and of air from the vegetable cellar. The well is in a bad position, because a sewer passes on either side of it within sixty or eighty feet. A new well, secure from any possible contamination by sewage, is very much needed.

#### REFORM SCHOOL.

##### *Dormitories.*

The sleeping-rooms in the main building are ventilated by a tin tube, 3 inches in diameter, set in the wall of each room. The air passes freely in most of these tubes. The door of each room is an open grating, so that air may freely pass from the large hall. The ventilation of these bed-rooms seems to be sufficient, and the rooms are of good size.

There is practically, no ventilation in the new east wing. At the top of the hall there are two ventilating cowls, about 12 inches in diameter. These are utterly inadequate to ventilate 60 bed-rooms. There is no attempt to ventilate the bed-rooms in this wing, except what is secured by the grated door opening into the hall.

The hospital is also without any ventilation.

*School-rooms.*

The former practice of holding an evening school in which the pupils studied 2½ hours by lamplight has been changed to a session of 1½ hours, and some of the worst results found two years ago, and reported in the report of this Board for 1873, are probably avoided by this change.

I only examined the air of the school-rooms in the day-time; the results in the evening when a large number of lamps are burning would probably exhibit a worse condition of air.

School-room No. 1.—Three windows partially open; two small ventilators (8 x 10 inches) near the top of the room; 52 boys present; air had a very repulsive odor and contained 19.43 parts of carbonic acid.

No. 3.—Three windows partially open; 4 small ventilators near the top of the room, 2 of them closed; the outside door wide open, and a gentle breeze could be felt blowing through the room; 46 boys present; air contained 9.31 parts of carbonic acid.

*Cottages.*

The cottages were erected in blissful ignorance that there is such a thing as ventilation. No provision is made for ventilation, either by entrance of fresh air or escape of foul air. When we remember that these cottages were built only a short time ago, it is discouraging to think that no progress is made in this important particular. The same discouraging feature is seen in the east wing, which was built only a few years ago.

There is no provision made for admitting fresh air into any of the buildings of the Reform School. The suggestions I have made in regard to method of introducing fresh air into the school at Coldwater, may apply with equal force to the Reform School.

*Water Supply.*

There are two wells on the premises, one a deep well at a safe distance from any source of sewage contamination, and the water appears to be of good quality. All the water for drinking and culinary use is derived from this well. The other is an artesian well, more than 500 feet deep. The water contains a large amount of mineral matter, and is not used for drink.

*Privies.*

The privies are on a modified form of the dry earth system, and are in a very satisfactory condition.

I cannot close this report without expressing my thanks to the officers in charge of these various institutions for the kind treatment which I everywhere received. Every assistance was most cheerfully given me in making my investigations. If I have spoken in severe terms of the stupid blunders in construction so often found, I wish it distinctly understood that the officers now in charge are in no way responsible for such mistakes. They are a legacy of the past, which will shed their baleful influence through the long future unless removed by appropriate and energetic means.

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# CEREBRO-SPINAL MENINGITIS.

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*Report to the State Board of Health upon an Epidemic in Monroe  
and Lenawee Counties, Michigan; and a Study of some  
other facts relative to the Cause of the Disease.*

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BY HENRY B. BAKER, M. D.,  
SECRETARY OF THE BOARD, AND MEMBER OF COMMITTEE ON EPIDEMIC, ENDEMIC,  
AND CONTAGIOUS DISEASES.

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## CEREBRO-SPINAL MENINGITIS.

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### REPORT.

*To the President and Members of the State Board of Health of Michigan :*

GENTLEMEN—Omitting details of circumstances which lead to this report, with which you are already familiar, by the general direction of the board I reached Blissfield in Lenawee county on the 22d of June, having selected that place as a starting point in order to avail myself of the assistance of Dr. H. C. Wyman, who had kindly volunteered to assist in obtaining a history of the epidemic. Dr. Wyman proved himself an energetic and enthusiastic worker in the cause of public health. I wish to acknowledge my indebtedness to him for valuable assistance.

In presenting the facts ascertained with reference to this epidemic, many of them are stated simply as facts supposed to have some bearing upon this subject, while as regards others I have thought that I could not do better than to briefly go over that part of the subject to which it seems to me each particular item presented is more or less closely related, and thus to indicate my own view of at least one of the relations which the item of evidence collected bears to the subject, and the conclusion to which the combined evidence tends. I have also collected, from the literature of the medical profession, numerous isolated facts relative to anatomy, physiology, pathology, and therapeutics, and have endeavored to group them in a way to render them of more practical value to humanity in connection with the study of this disease.

More or less evidence has been collected concerning 88 cases of unusual sickness: 33 cases having occurred at or near the village of Dundee, 40 cases at or near the village of Petersburg, 2 cases at or near the village of Deerfield, 5 cases at or near the village of Blissfield, 2 cases in the township of Raisinville, and 6 cases in or near the city of Monroe.

Monroe, Raisinville, Dundee, and Petersburg are all in Monroe county; Deerfield and Blissfield are in Lenawee county. All these places have indirect, Monroe, Petersburg, and Deerfield have direct railway communication each with the other. The city of Monroe and the four villages named above are all situated on the banks of the River Raisin, which also runs through the township of Raisinville. The river is not a large one; it is not a navigable stream. The water in the river is not clear; in fact, at that time it was quite turbid. There is a mill-dam at each village, and a slight odor sometimes arises from the water, especially as it pours over the dam. At Petersburg complaint was made that a "flood-wood" very near the village was the cause of a bad odor

in its immediate vicinity; and at this and other places I was more than once referred to the river and the dams as the cause of the epidemic from which they had just suffered.

Analysis of water taken from the River Raisin at Deerfield, Sept. 8, 1874, by Prof. R. C. Kedzie of this board resulted as follows: In each imperial gallon, 20.3 grains of solid matter, of which 9.8 grains was organic matter containing nitrogen.

All along the river in this vicinity there are many bayous and flat places which are under water when the water is high, and dry when it is low. Opposite such places one frequently experiences the peculiar pungent odor sometimes given off by aquariums and ferneries containing ferns, mosses, etc., and occasionally this is united with an odor like that from a drained mill-pond in process of drying up.

The prevailing diseases of this locality are usually the intermittent and remittent fevers.

#### EFFORT TO TRACE THE SPREAD OF THE DISEASE.

I was told that cerebro-spinal meningitis had not prevailed just in this locality for several years, at least not to any great extent. I find, however, on examining the returns of deaths, made by the supervisors, that in 1868 there were in the township of London, which adjoins Dundee, four deaths attributed to "spotted fever." Three of these deaths occurred in one family. In 1871 there was one death, and in 1873 one death in the same township. These were all the deaths returned from Monroe county from this disease in 1867, 1868, 1869, 1870, or 1871. For the year 1872, however, ten deaths were returned, but none of them occurred in either Dundee or Petersburg. For the year 1873, eight deaths from this disease were returned from Monroe county, one having occurred in Dundee and one in Summerfield, in which township the village of Petersburg is situated. Dr. Paquette told me of another death near Petersburg in the fall of 1873, which at the time was thought to be a case of poisoning. He now thinks it was this disease. The patient was a lady, and the body was buried in the village cemetery. Dr. Jackson gave me notes of one case at Dundee, January 1, 1874, which died on the third day.

This epidemic began about the same time at Dundee that it did at Petersburg. The first case at Petersburg occurred March 3, 1874, and the patient was still sick when I was there, June 23. The first case, during the epidemic, at Dundee, occurred March 7,—four days later than the one at Petersburg. The patient was convalescent on the 54th day after the attack. The last case at Dundee was attacked May 4. Most of the cases at Dundee occurred during March and April, while most of the cases at Petersburg were in April and May. Those at Deerfield were in May. The cases of unusual sickness at Blissfield occurred in May and June.

#### IS THE DISEASE COMMUNICABLE?

From the preceding statement of cases of the disease in that vicinity previous to this epidemic, it will be seen that there appears to have been abundant opportunity for the disease to have spread either by contagion or infection, if it is ever possible for it to spread in such manner.

The physicians in the villages visited were unanimous in saying that they saw no conclusive evidence of its being contagious. I collected some evidence

which might be construed in a way to show that it was communicable in some manner, but which was nearly as well explained by the fact of persons having been placed under similar conditions. In relation to this subject, John Netten Radcliffe, in his essay on "Epidemic Cerebro-Spinal Meningitis," in J. Russell Reynolds' "System of Medicine," says:

"The great majority of observers have come to the conclusion that the disease is incommunicable from the sick to the well. Among the minority who hesitate to accept this deduction without reservation are Professor Hirsch, Professor Stokes, and Mr. J. Simon. The facts which suggest the possibility of the active cause of the disease being portable in some way are of the following character: (\*) A child was seized with epidemic cerebro-spinal meningitis and died. A second child of the same family was attacked with the malady a few days later. The day following the attack of this child, the mother, who slept in the same bed with it, sickened of the disease.<sup>1</sup>

"(\*) 1. On the 8th of February, 1865, a youth, aged 20 years, was attacked with the characteristic symptoms of epidemic cerebro-spinal meningitis. He was nursed by a woman from another village. The youth died, and after his death the woman returned home. She soon sickened, and she died of the epidemic disease on the 26th February. There had been but one case previously in the village. To the interment of the woman, the funeral obsequies, as customary in the district, being performed with the coffin open, came a family from another locality. After the return home of this family, a child three months old, sickened immediately of meningitis, and died within twenty-four hours. Then a man who had accompanied the family to the interment was attacked with the disease, and died on the 2d of March. Lastly, a girl in the same locality who had also been at the funeral, was seized, and died on the 7th March. 2. At another village, two children of one family, aged three and a half and one and a half years respectively, died of the epidemic,—one on the 27th January, the other on the 7th February. The clothes of the deceased were taken to a neighboring village, and came into the possession of a girl aged five years. She soon sickened of the epidemic, and died on the 14th February.<sup>2</sup>"

"It is obvious that contagiousness of a like character to that of small-pox, scarlet fever, or typhus, is not possessed by the malady under consideration. The question is: Does epidemic meningitis, like typhoid fever or cholera, possess a peculiar contagiousness of its own, a property of communicability peculiar to itself? This has yet to be solved."

#### PREVIOUS CASES NOT FAR DISTANT.

In addition to the cases already mentioned, I was told that cases of the disease occurred the preceding fall in Milan, eleven miles from Dundee. There is direct railway communication between Milan and Dundee. Three or four rivers run through the township and afterwards empty into the river Raisin, but below Dundee and all the other places named, except Raisinville and Monroe. Cases were also reported as having occurred at Manchester, in Washenaw county. Since then I have visited Manchester, and found that the disease prevailed there in the preceding August, 1873. There is direct railway communication between Manchester and Blissfield, and communication with the other places by changing cars. Manchester is situated on the river Raisin.

<sup>1</sup> Professor Stokes, *The Medical Press and Circular*, June 19, 1867, p. 592.

<sup>2</sup> Hirsch, *Transactions of the Epidemiological Society*, vol. 2, p. 378.

nearer its source than any of the places yet named. Cases have been reported as having occurred previous to that time in Jackson county, at different places along this same river Raisin still nearer its source, and in the city of Jackson, which has direct railway communication with Manchester and Blissfield. In the returns of deaths for the year 1873, the supervisor of the township of Norvell reports one death from this disease on the 13th of April, 1873. The village of Norvell is on the bank of the river Raisin, above Manchester. Deaths are also reported from this disease in Napoleon, in the spring of 1873.

As it is possible that undue importance may be attached to the fact that cases of this disease occurred along this river, and were traced backwards in order of time as the stream was ascended toward its source, it may be well to state that during the spring of 1873, this disease prevailed in various localities throughout the State. The returns of deaths for that year have not yet been compiled in a way to show how extensively, but an examination of the returns for Branch county reveals the fact that 32 deaths are returned from "cerebro-spinal meningitis," "spinal fever," etc. According to the proportion of deaths to cases in Petersburg, Dundee, and Blissfield, those 32 deaths represent about one hundred cases of the disease in Branch county during the year 1873. The returns for Ingham county include 15 deaths, which may, probably, be attributed to this disease, some of them appearing, however, as deaths from "spinal fever." For Allegan county the returns show 98 deaths during the year 1873, from specified causes such as may be supposed to be this disease, modified by different circumstances, such as age, sex, inter-current disease, etc. Following back, it appears from the returns of deaths from Allegan county, for the year 1872, that there were in that year 12 deaths from this disease. In 1871 there were 5 deaths. For 1870, and for 1869, no deaths were returned from that county from that cause; but one death is returned as having occurred in October, 1868.

At different times in the past, this disease has prevailed more or less extensively at several places within this State. But any attempt to trace it now is attended with very great difficulty, for the reason that the attention of physicians, and of the people, was at that time almost entirely directed to efforts in the direction of cure, and no permanent provision had then been made, either for studying the cause of the disease, or recording the coincident facts and results that it might afterward be studied.

Mortality statistics have only been collected in Michigan since 1867. The first statistical evidence of this disease in Michigan, was in the second Registration Report, for the nine months ending December 31, 1868, in which are reported 7 deaths from "spotted fever." For the year 1869, there were reported 5 deaths; for 1870, 9; and for 1871, 18 deaths. During the year 1872, the number of deaths from this disease appears to have been much increased, and in 1873 very greatly increased, as indicated by the returns from the three counties before referred to,—Branch 32, Ingham 15, and Allegan 98 deaths. The deaths during the year 1874, will not be enumerated until the spring of 1875, but it seems probable that in 1874, there were in the State a less number of deaths from the disease under consideration than occurred during the year 1873. In Lansing, several deaths from this disease occurred in the spring of 1873, while the disease did not prevail there in 1874. In view of these facts, we have, among other questions, to consider why the disease prevailed so extensively at Petersburg and Dundee in 1874, and did not in 1873, when some other localities within the State were suffering most severely.

## PREVALENCE OF THE DISEASE OUTSIDE OF THIS STATE.

In a report to the New York City Board of Health, Dr. Moreau Morris, City Sanitary Inspector, says: "During the early part of January, 1872, reports of a 'new form of disease' began to reach the Bureau of Sanitary Inspection. Some called it 'spotted fever,' others 'epidemic meningitis,' a 'fever resembling typhoid,' and 'typhoid complicated with acute meningitis.'" "Isolated cases had occurred during previous years." "Deaths had been recorded from 'cerebro-spinal meningitis,' in 1866, 18; in 1867, 32; in 1868, 34; in 1869, 42; in 1870, 32; in 1871, 48." From January 1 to November 1, 1872, 761 deaths from this disease were reported to the Health Department of New York city.

From a report to the State Board of Health of Massachusetts, in 1873, by J. Baxter Upham, M. D., it appears that the first reliable record of this disease as an epidemic in that State was of 9 fatal cases in the town of Medfield in March, 1806. "It prevailed quite extensively in 1810." Between the years 1806 and 1816 it appeared at intervals at various points within the State. From that time little was heard of the disease until March, 1849. "It appeared again, to a limited extent, in April, 1857." Below is a statement of cases reported in 1866 to the Medical Society of that State:

In 1857 there were	3 cases.
" 1858 " "	27 "
" 1859 " "	3 "
" 1860 " "	" "
" 1861 " "	5 "
" 1862 " "	5 "
" 1863 " "	7 "
" 1864 " "	88 "
" 1865 " "	116 "
" years not designated there were	26 "
Total	280 "

In 1866 the record was not complete, but included 7 cases. From that time until 1872 no proper record could be found, as regards the State, but in the city of Boston there were returned, in 1867, 7 deaths; in 1868, 8 deaths; in 1869, 7 deaths; in 1870, 5 deaths, and in 1871, 3 deaths. In 1872 it appears for the first time in the State nosological records under its true name." In that year 175 deaths were returned from this cause, the cases being scattered throughout the State. In the epidemic of 1873 there were reported 517 cases of the disease, and the mortality is stated to have been "a little less than 44 per cent"—(about 227 deaths?) At this rate of mortality the 175 deaths in 1872 would represent about 397 cases of the disease.

This disease has prevailed in different parts of the civilized world since 1805, and it may be for a long period of time previous to this century. I shall make no elaborate attempt to give a history of the disease. It is not at all probable that it would be possible for any person to give a complete history, for the reason that it not infrequently happens that it is called by some other name. "It was not recognized as a distinct affection until the beginning of the present century."\* "While Paumier describes something very much like it

at Paris in 1568, the first clearly recognized occurrence of it was at Geneva in 1805; after which it was traced in a number of different localities on the Continent in 1806-7, 1811, 1813-14-15-16, and 1823. At Geneva, "the characters described were: Sudden attack in the night, vomiting of green matter, atrocious cephalalgia, spinal rigidity, difficulty of deglutition, convulsions, nocturnal exacerbations, petechiæ, death occurring after from twelve hours to five days of illness. At Grenoble, in 1814, one variety was observed with tetanus, and another without tetanus. In the department of Landes, 1837, there was also remarked, in certain cases, exaltation of the tegumentary sensibility. The disease attacked persons of all ages, and both sexes, although the smallest number of cases occurred in females." \*

In another part of this report, in connection with the subject of "Food as a cause of this disease," reference is made to various other epidemics of cerebro-spinal meningitis, most of which occurred in foreign countries. Also, in connection with "An effort to trace the cause of some previous epidemics," reference is made to some others which have occurred in this country.

TABLE I.—Exhibiting for each Case of Cerebro-Spinal Meningitis reported as having occurred in Lenawee and Monroe counties during the epidemic of 1874, the Residence, Date of Attack, Sex, Age, Day of Death after Attack, and Day of Convalescence after Attack.

RESIDENCE OF PATIENT AT OR NEAR	DATE OF ATTACK.	SEX.	AGE IN YEARS.	Day of Death after Attack.	Day of Convalescence after Attack.
Dundee.....	January 1st..	Male.....	6	3d	----
Petersburg.....	March 3d....	Male.....	13	149th	----
Dundee.....	March 7th....	Female.....	10-12	----	54th
Dundee.....	March 8th....	Male.....	21	----	17th
Dundee.....	March 13th....	Male.....	9	68th	----
Petersburg.....	March 16th....	Male.....	7	3-24	----
Ida.....	March 18th....	Male.....	14	----	21st
Dundee.....	March 20th....	Male.....	15	----	10th
Dundee.....	March 20th....	Female.....	19	2d	----
Dundee.....	March 22d....	Male.....	5	----	28th
Dundee.....	March 23d....	Male.....	44	7th	----
Dundee.....	March 23d....	Male.....	32	----	8th
Dundee.....	March 24th....	Male.....	23	7th	----
Dundee.....	March 25th....	Male.....	3	----	24th
Petersburg.....	March 25th....	Male.....	17	10th	----
Dundee.....	March 26th....	Male.....	5	4th	----
Dundee.....	March 26th....	Male.....	4	----	19th
Dundee.....	March 29th....	Male.....	18	3d	----
Monroe.....	March 29th....	Female.....	17	----	24th
Dundee.....	March 30th....	Male.....	3	----	31st
Dundee.....	March 31st....	Female.....	11	----	31st
Dundee.....	April 1st....	Male.....	3	----	28th
Dundee.....	April 1st....	Female.....	2½	----	14th
Dundee.....	April 2d....	Male.....	½	6th	----
Dundee.....	April 2d....	Female.....	28	22d	----
Dundee.....	April 3d....	Male.....	5	----	9th
Dundee.....	April 4th....	Male.....	27	----	3d
Dundee.....	April 4th....	Male.....	6	----	26th
Monroe.....	April 4th....	Male.....	23	----	16th
Dundee.....	April 6th....	Female.....	26	----	39th
Dundee.....	April 7th....	Male.....	8	----	32d
Petersburg.....	April 7th....	Male.....	1½	----	56th

\* Dr. Henry Hartschorn, quoted from the Am. Jour. of Med. Sci., July, 1864, p. 93.

## CEREBRO-SPINAL MENINGITIS.

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TABLE I.—Continued.

RESIDENCE OF PATIENT, AT OR NEAR	DATE OF ATTACK.	SEX.	AGE IN YEARS.	Day of Death after Attack.	Day of Convalescence after Attack.
Raisinville.....	April 7th.....	Female.....	12	.....	68th
Dundee.....	April 8th.....	Male.....	30	.....	54th
Raisinville.....	April 9th.....	Female.....	13	.....	15th
Petersburg.....	April 10th.....	Female.....	13	86th	.....
Dundee.....	April 11th.....	Male.....	23	.....	9th
Petersburg.....	April 16th.....	Male.....	9	.....	20th
Petersburg.....	April 16th.....	Male.....	13	.....	79th
Dundee.....	April 18th.....	Female.....	20	.....	9th
Dundee.....	April 19th.....	Male.....	29	26th	.....
Dundee.....	April 20th.....	Male.....	4	.....	18th
Monroe.....	April 20th.....	Male.....	17	.....	71st
Petersburg.....	April 23d.....	Male.....	46	6th	.....
Petersburg.....	April 28th.....	Female.....	13	.....	35th
Petersburg.....	April 29th.....	Male.....	46	6th	.....
Petersburg.....	April 29th.....	Female.....	21	.....	4th
Dundee.....	April 30th.....	Female.....	23	.....	25th
Petersburg.....	May 2d.....	Male.....	14	.....	4th
Petersburg.....	May 2d.....	Male.....	44	.....	35th
Petersburg.....	May 2d.....	Male.....	40	4th	.....
Dundee.....	May 3d.....	Male.....	29	.....	17th
Dundee.....	May 4th.....	Female.....	24	.....	25th
Monroe.....	May 4th.....	Female.....	5	27th	.....
Petersburg.....	May 5th.....	Female.....	14	.....	30th
Petersburg.....	May 5th.....	Female.....	11	5th	.....
Petersburg.....	May 5th.....	Female.....	4	.....	*
Blissfield.....	May 6th.....	Male.....	21	.....	3d
Petersburg.....	May 8th.....	Female.....	8	2d	.....
Blissfield.....	May 10th.....	Male.....	10	.....	3d
Petersburg.....	May 10th.....	Female.....	23	.....	37th
Petersburg.....	May 10th.....	Female.....	13	2d	.....
Petersburg.....	May 12th.....	Male.....	14	.....	17th
Petersburg.....	May 12th.....	Female.....	75	.....	5th
Petersburg.....	May 12th.....	Female.....	11	.....	14th
Petersburg.....	May 12th.....	Female.....	3	.....	14th
Petersburg.....	May 12th.....	Female.....	2	.....	14th
Petersburg.....	May 12th.....	Female.....	12	7th	.....
Deerfield.....	May 13th.....	Male.....	20	.....	10th
Deerfield.....	May 14th.....	Female.....	7	3-24	.....
Petersburg.....	May 18th.....	Female.....	30	.....	8th
Monroe.....	May 18th.....	Female.....	7	17th	.....
Petersburg.....	May 19th.....	Female.....	36	4th	.....
Petersburg.....	May 19th.....	Female.....	6	.....	*
Petersburg.....	May 19th.....	Female.....	50	4th	.....
Petersburg.....	May 22d.....	Female.....	15	4th	.....
Petersburg.....	May 22d.....	Female.....	12	.....	29th
Monroe.....	May 27th.....	Male.....	5	.....	10th
Petersburg.....	May 29th.....	Male.....	45	.....	11th
Blissfield.....	May 30th.....	Female.....	35	.....	10th
Petersburg.....	May 31st.....	Male.....	63	5th	.....
Petersburg.....	May 31st.....	Female.....	60	3d	.....
Petersburg.....	June 2d.....	Female.....	18	.....	2d
Petersburg.....	June 4th.....	Male.....	5	.....	8th
Petersburg.....	June 9th.....	Female.....	45	.....	7th
Blissfield.....	June 18th.....	Female.....	30	.....	2d
Blissfield.....	June 23d.....	Female.....	37	.....	3d
Petersburg.....	June 23d.....	Female.....	47	.....	?
Petersburg.....	.....	Male.....	6	?	.....

\* Sick June 24, 1874.



TABLE II.—*Exhibiting by Sex and by Age, the number of Cases of Cerebro-Spinal Meningitis in Petersburg, Dundee, Deerfield, Blissfield, Raisinville, Ida, and Monroe, during the Epidemic in Spring of 1874.*

		AGES IN YEARS AND PERIODS OF YEARS.														
LOCALITY.	Sex.	All Ages.	Under One Year.	1 to 2.	2 to 5.	5 to 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 & ov'r	
Total of all localities visited ..	Total.....	89	2	2	9	17	15	9	16	7	8	1	2	1	---	
	Males.....	47	1	2	5	12	4	5	9	2	6	---	1	---	---	
	Females ..	42	1	---	4	5	11	4	7	5	2	1	1	1	---	
Petersburg {	Total.....	40	---	2	3	6	11	3	2	2	7	1	2	1	---	
	Males.....	16	---	2	---	4	3	1	---	---	5	---	1	---	---	
	Females ..	24	---	---	3	2	8	2	2	2	2	1	1	1	---	
Dundee {	Total.....	33	2	---	6	7	1	3	11	2	1	---	---	---	---	
	Males.....	24	1	---	5	7	---	2	6	2	1	---	---	---	---	
	Females ..	9	1	---	1	---	1	1	5	---	---	---	---	---	---	
Deerfield {	Total.....	2	---	---	---	1	---	---	1	---	---	---	---	---	---	
	Males.....	1	---	---	---	---	---	---	1	---	---	---	---	---	---	
	Females ..	1	---	---	---	1	---	---	---	---	---	---	---	---	---	
Blissfield {	Total.....	5	---	---	---	---	1	---	1	3	---	---	---	---	---	
	Males.....	2	---	---	---	---	1	---	1	---	---	---	---	---	---	
	Females ..	3	---	---	---	---	---	---	---	3	---	---	---	---	---	
Raisinville {	Total.....	2	---	---	---	---	2	---	---	---	---	---	---	---	---	
	Males.....	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	Females ..	2	---	---	---	---	2	---	---	---	---	---	---	---	---	
Ida {	Total.....	1	---	---	---	---	---	1	---	---	---	---	---	---	---	
	Males.....	1	---	---	---	---	---	1	---	---	---	---	---	---	---	
	Females ..	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Monroe {	Total.....	6	---	---	---	3	---	2	1	---	---	---	---	---	---	
	Males.....	3	---	---	---	1	---	1	1	---	---	---	---	---	---	
	Females ..	3	---	---	---	2	---	1	---	---	---	---	---	---	---	

TABLE III.—*Exhibiting, by Sex and by Age, the number of Deaths from Cerebro-Spinal Meningitis in Petersburg, Dundee, Deerfield, Blissfield, Raisinville, Ida, and Monroe, during the Epidemic of 1874.*

THIS EPIDEMIC.	SEX.	AGES IN YEARS AND PERIODS OF YEARS.														
		All Ages.	Under One Year.	1 to 2.	2 to 5.	5 to 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 & ov'r	
Deaths.....	Total.....	29	1	---	---	8	5	4	3	1	4	1	2	---	---	
	Males.....	15	1	---	---	4	1	2	2	---	4	---	1	---	---	
	Females ..	14	---	---	---	4	4	2	1	1	---	1	1	---	---	

Of the 29 persons who died of this disease in this epidemic :

13 out of 29 died on or before the 4th day of the disease.

15 " " " " " " " " 5th " " " "

18 " " " " " " " " 6th " " " "

21 " " " " " " " " 7th " " " "

The eight others died as follows: 1 on the 10th; 1 on the 17th; 1 on the 22d; 1 on the 26th; 1 on the 27th; 1 on the 68th; 1 on the 86th; 1 on the 149th. This last was the first well-recognized case at Petersburg.

The mortality was greatest in the first part of the epidemic. If the 88 cases in which the date of attack was specified be divided in three parts according to date of attack, out of the first 29 cases there were 12 deaths, out of the next 30 cases there were 8 deaths, and in the last 29 cases there were 9 deaths.

The death-rate in this epidemic was smaller than usually reported, being only 32.95 per cent of all cases. In the epidemic in Massachusetts during the year 1872 it is reported by Dr. Upham as "a little less than 44 per cent."\*

In New York city in 1872, it was reported as 75.45 per cent. It is possible that the large death-rate in New York may be accounted for in part by a failure to report cases in as great proportion as deaths, and in part by unsanitary conditions. It is also possible that the death-rate is quite frequently stated too high because of the constant effort of those who study the disease to exclude all except undoubted cases, which usually means severe cases. Mild cases should, if possible, be considered as well, for they may be important in tracing the cause.

During the first part of this epidemic more males than females seem to have been attacked with the disease. The sexes were attacked as follows:

Petersburg-----	{ First half 11 males, 7 females. Last half 4 males, 18 females. Unknown date 1 male, 1 female.
Dundee-----	{ First half 13 males, 8 females. Last half 11 males, 5 females, 1 unknown sex.
Blissfield-----	{ First half 2 males, 0 females. Last half 0 males, 3 females.
Dearfield-----	{ One case—1 male.
All cases in this epidemic-----	{ First half 33 males, 11 females. Last half 13 males, 31 females. Unknown date 1 male, 0 females.
Elmira, N. Y., 1856-7-----	{ First half 18 males, 4 females. Last half 12 males, 8 females, 1 unknown sex.

On page lxxv. of the Registration Report of Massachusetts for the year 1873 it may be seen that during the first part of the year more males than females died from this disease, and in the latter part of the year the reverse was true.

*DEATHS from Cerebro-Spinal Meningitis in Massachusetts in 1873.*

SEX.	1873.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Males-----	393	9	14	59	91	79	42	85	25	12	8	8	11
Females-----	354	4	11	48	94	65	37	28	17	13	10	16	11
Totals ----	747	13	25	107	185	144	79	63	42	25	18	24	22

Whether or not this was an expression of any general tendency can hardly be determined from the material at hand, no other data having been published heretofore, so far as I can learn, which will enable me to ascertain the fact.

The average age of all persons of both sexes taken with cerebro-spinal

\* Report S. B. of Health of Mass., 1874, p. 808.

meningitis at Dundee, Petersburg, Monroe, Raisinville, Deerfield, Blissfield, and Ida, during this epidemic, and the average age of each of three equal parts of the whole number, divided according to date of attack, was as follows:

Cases. ....	{	Average age of first third.....	13.56 years.
		Average age of second third.....	18.79 years.
		Average age of all cases.....	19.22 years.
		Average age of last third.....	25.31 years.

The average age of all who died of this disease during this epidemic, stated as above, according to date of attack, was as follows:

Deaths ....	{	Average age of first third.....	16.10 years.
		Average age of all deaths.....	22.40 years.
		Average age of second third.....	24.28 years.
		Average age of last third.....	27.00 years.

In an epidemic of this disease which occurred at Elmira, N. Y., in 1857, in which there were 43 deaths, the average age of all who died, stated as above, according to date of attack, was as follows:\*

Deaths ....	{	Average age of first third.....	11.21 years.
		Average age of all deaths.....	13.92 years.
		Average age of second third.....	14.26 years.
		Average age of last third.....	16.29 years.

Excepting the deaths during the epidemic at Elmira, reported by Dr. T. H. Squire, I have searched in vain for any table or record of cases from which I could gather information on the subject noted above, as taken from Table I. of this report. So far as this evidence goes, it seems to show that those first attacked are younger than those who are attacked later in the same epidemic.

Dividing the 29 fatal cases in the epidemic in this State into three groups, according to age of decedents, I find 14 aged under 15 years, 7 aged between 15 and 30 years, and 8 aged over 30 years. Now, although those first attacked were the youngest, the average duration of the disease was also greater among those aged under 15 years, as appears as follows:

Average duration of fatal cases--	{	14 aged under 15 years, 26.87 days.
		7 aged 15 to 30 years, 10.57 days.
		8 aged over 30 years, 4.87 days.

The mortality was least among those cases aged 15 to 30, and greatest among those aged 30 years and over. Dividing the 88 cases of which the result is stated into three groups as above, I find 45 cases, including 14 deaths, in the first group; 24 cases, 7 deaths, in the second group; and 19 cases, 8 deaths, in the last group. The death-rate is as follows:

Proportion of deaths to cases.....	{	Among persons aged under 15 years, 31.11 per cent.
		Among persons aged 15 to 30 years, 29.17 per cent.
		Among persons aged 30 years and over, 42.10 per cent.

The question relative to what classes of persons are first attacked by this disease is a very interesting one, and one which does not seem to have been studied heretofore. In order to answer this question, it is essential to have the material grouped in a different manner than it is usually tabulated. Tables of cases arranged by ages alone, as is quite common, or by months alone, as is occasionally done, are of no use for this purpose. It is essential to have the

\* Computed from a report of deaths during the epidemic by T. H. Squire, M. D., in Trans. N. Y. State Med. Soc., 1858.

important facts relative to all cases so grouped as that the date of attack, sex and age of patient, duration and result of the disease, shall all appear in connection with each other, as they do in Table I., relative to this epidemic. Inasmuch as evidence of this kind is not very accessible, I have thought it advisable to compile such a table from the report of fatal cases in the epidemic at Elmira, N. Y., published by T. H. Squire, M. D., in Trans. N. Y. State Med. Soc., 1858. From this table the preceding items relative to that epidemic have been taken.

TABLE IV.—*Exhibiting the Date of Attack, Sex, Age, and day of Death after Attack, for each fatal case of Cerebro-Spinal Meningitis reported as having occurred at or near Elmira, N. Y., in epidemic of 1856-7.*

DATE OF ATTACK.	Sex.	Age in Years.	Day of Death after Attack.	DATE OF ATTACK.	Sex.	Age in Years.	Day of Death after Attack.
1856.				1857.			
Dec. 23.....	Male....	14	5	March 25.....	Male....	3	3
1857.				March 26.....	Male....	36	285
January 1....	Male....	13	5	March 26.....	Male....	16	4
February 11..	Female..	7	3	March 28.....	Female..	11	120
February 13..	Male....	8-12	3-24	March 30.....	Male....	8-12	18-24
February 2....	Female..	5	7-24	April 2.....	Male....	4	3
February 24..	Male....	12	1	April 5.....	Female..	17	6
March 4.....	Male....	1 1-3	6-24	April 6.....	Female..	41	2
March 6.....	Male....	6	1	April 7.....	Male....	17	64
March 9.....	Male....	10	3	April 8.....	Female..	4	4
March 10.....	Male....	5	1	April 13.....	Male....	19	5
March 10.....	Male....	30	3	April 28.....	Female..	11	2
March 12.....	Male....	42	1	May 5.....	Male....	23	14-24
March 14.....	Male....	4	14-24	May 6.....	Female..	4	12-24
March 16.....	Male....	7	3	May 19.....	.....	3-12	2-24
March 20.....	Male....	7	53	May 19.....	Male....	2	6-24
March 21.....	Male....	8	6-24	May 21.....	Female..	1 1-6	12-24
March 21.....	Female..	6	2-24	May 24.....	Male....	40	5
March 21.....	Male....	25	9	May 27.....	Male....	7	4-24
March 24.....	Male....	39	3	May 27.....	Female..	32	3
March 23.....	Female..	23	1	June 20.....	Male....	23	18
March 25.....	Male....	5	1	August 15....	Male....	20	4

At Elmira, N. Y., in 1856-7, the average duration of the disease was greater in the last half than in the first half of the fatal cases, as appears as follows:

Average duration of fatal cases { First 22 attacked, 4 days and 11 hours.  
at Elmira, N. Y., in 1856-7.. } Last 21 attacked, 25 days and 3 hours.

The average duration of fatal cases in this epidemic in Michigan was as follows:

First 14 fatal cases attacked, 28 days and 2 hours.

Last 15 fatal cases attacked, 6 " " 9 "

As stated on a preceding page, however, the mortality was greatest among those first attacked.

#### DEFINITION OF CEREBRO-SPINAL MENINGITIS.

The following definition is from Dr. Clymer's work on this subject:

"Definition.—[An acute specific disorder, commonly happening as an epidemic, general or limited, and, rarely, sporadically, caused by some unknown external influence; of sudden onset, rapid course, and very fatal; its chief

symptoms referable to the cerebro-spinal axis, are, great prostration of the vital powers, severe pain in the head and along the spinal column, delirium, tetanic and occasionally clonic, spasms, and cutaneous hyperæsthesia, with, in some cases, stupor, coma, and motor paralysis; attended frequently, with cutaneous hæmic spots; its morbid anatomical characters being congestion and inflammation of the membranes of the brain and spinal cord, particularly the pia mater, although there is reason to believe that the evidence of these changes may be wanting, even in cases of long duration.”]

“The name cerebro-spinal meningitis is not a proper one for this affection, even with the prefix ‘epidemic,’ for, as Dr. Valleix remarks, it is ‘begotten of anatomical bias and an incomplete appreciation of the facts.’ It gives no accurate notion of the real nature of the disorder, and takes heed only of the local structural changes, which are, probably, secondary, and may be wanting. It has also been called *typhoid meningitis*, *malignant meningitis*; but to these names the same objections lie. *Spotted fever* is hardly distinctive enough, there being so many other essential disorders in which spots on the skin appear. *Petechial fever* has been proposed by Dr. G. B. Wood, of Philadelphia. Dr. W. Stokes calls it *malignant purpuric fever*; and Dr. R. D. Lyons *febris nigra*.”\*

“The name of the disease is apt to fix the attention on local structural changes (which are probably only secondary, and may not always be present) to the exclusion of a consideration of the real nature of the malady.”†

Dr. Rodenstein has proposed the name *Tetanoid Fever*. I will hereafter give reasons why I think it the best name yet proposed, although I do not quite agree with the last paragraph quoted. He says:

“But in a not inconsiderable number of autopsies no such evidence of inflammation could be found in the envelopes of the cerebro-spinal axis. These cases, although not as numerous as the others, are nevertheless sufficient to prove that the disease under consideration is not a meningitis. Can we conceive of a pneumonia which in the event of a fatal issue would show no evidence of inflammation of the lung? Is it easier to conceive of a meningitis without the signs of an inflammation of the meninges?‡

“I believe that meningitis stands in a relationship to tetanoid fever similar to that which nephritis sustains to scarlatina; and that iridio choroiditis, labyrinthitis, arthritis, etc., are independent manifestations of a general tendency of tetanoid fever to local inflammation, of which meningitis is another and the most conspicuous illustration.”†

The following remarks by Dr. Stillé tend toward a similar conclusion:

“As the pulse never acquires the force and sustained frequency which belongs to it in pure inflammations or in idiopathic fevers, so the heat of skin is always less than in those affections, and is constantly undergoing vicissitudes such as are observed in no other disease.”||

In April, 1863, Dr. W. W. Gerhard reported to the College of Physicians of Philadelphia relative to “Spotted Fever” occurring in neighboring towns in the vicinity of that city. In speaking of the nature of the disease he said:

“The anatomical lesions thus confirmed the conclusions at which I had already arrived respecting the pathology of the disease. That is, it is strictly

\* Meredith Clymer's *Cerebro-Spinal Meningitis*, pp. 5-6.

† Quoted from Aitken's *Sci. and Prac. of Med.*, Vol. II., p. 448.

‡ “Thermometry in Cerebro-Spinal Meningitis,” by C. F. Rodenstein, M. D., pp. 210, 211.

|| Stillé on *Epidemic Meningitis*, p. 57.

a blood disorder unconnected with any structural lesion. The internal ecchymoses of blood are precisely similar to the spots on the skin, and are evidently depending on the same cause. This fact establishes a wide distinction between them and those appearing in typhus and typhoid fevers, as well as the eruptions of the exanthemata. Although the proof of spotted fever being a blood disease is to my mind conclusive, it must not be ascribed to an impoverished condition of this fluid from innutritious or deficient food, as none of the patients whom I saw was in a condition of actual poverty, and a large majority of them belonged to a class amply supplied with all the comforts of life." \*

In April, 1864, Dr. Levick reported some cases of "Spotted Fever" to the College of Physicians of Philadelphia. In the course of his report he referred to the nature of the disease as follows:

"Nor do I doubt that there may be in many cases of spotted fever, especially when it assumes the chronic form, inflammation of the meninges of the brain and spinal cord, but that this is necessarily present,—constitutes the essence of the disease,—I do not believe. In scarlet fever we have almost uniformly inflammation of the throat, but no one looks upon scarlatina as mere angina; in measles we have coryza and catarrh, but rubeola is not simply inflammation of the air-passages. Still more strikingly there are in typhoid fever inflammation and ulceration of Peyer's glands with suppuration of those of the mesentery, but certainly no one regards this fever as simply meso-enteritis. These are concomitants, frequent concomitants, of these diseases, local manifestations of a general constitutional disorder, which may be present or may be absent. So with spotted fever. That this is not simple cerebro-spinal meningitis is proved by the fact that though present in some cases, in others all traces of intracranial inflammation have been absent, and this too when all other phenomena of the disease have been characteristically developed. Nor are the remedies which have been found most useful in spotted fever those which are recognized as suited to inflammation of the brain or its meninges. The testimony which comes to us from almost every quarter, with astonishing unanimity, is that blood-letting, mercury, and other familiar antiphlogistic measures are utterly inefficient, are indeed worse than useless, while the only medicines, the exhibition of which has been attended with any success, are quinia, brandy, and turpentine, the remedies everywhere recognized as those suited to the typhus state. Tried thus by the therapeutic test, the disease fails to hold its position as one of pure inflammation, unless indeed we abandon all our former standards of pathology and of treatment. Hence it is that the name cerebro-spinal meningitis is an objectionable one, as giving erroneous impressions as to the nature of the disease, and as leading to an injudicious and dangerous course of treatment." \* \*

"If, then, this disease be not simple cerebro-spinal meningitis, what is it? I believe it to be, as I have elsewhere expressed it, a malignant febrile disorder, due to a widespread epidemic influence, which acts with intensity on the blood directly, or indirectly through the nervous system. Thus poisoned, the blood is altered in its nature and in its function. Hence follow deranged innervation, impaired nutrition, passive congestions, escape of blood into various tissues, delirium, coma, prostration, and death, the usual results of septicæmia. So far as I can discover, in every autopsy of this disease on record, the

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\*Am. Jour. Med. Sci., July, 1868, p. 108.

blood has been found to be fluid, both in the heart and great vessels, or if coagula have been found in the heart they have been small and soft.”\*

#### SYMPTOMS USUALLY PRESENT IN THIS DISEASE.

“A chill, headache, vomiting, prostration, morbid sensitiveness of the skin, jactitation, coldness of the surface, wildness of expression, dilated pupils, irregular breathing, paralyzed deglutition, wry neck, retraction of the head, dullness or abolition of the senses, pulse but little affected, bowels quiescent, petechia, delirium, convulsions, coma; these are impressive symptoms, and many, or all of them, attend each case.”†

#### SYMPTOMS GENERALLY PRESENT IN THIS EPIDEMIC.

The first case at Petersburg of which I have notes was Frank Gunsolus, aged 13 years, taken sick March 3, 1874. He was a brother of a prominent physician of that place, from whom I received some account of the case. He had a chill with vomiting for thirty hours; then violent fever, opisthotonos, lockjaw, and double vision for four days. There was increased sensitiveness of the skin, large copper-colored spots about the size of a five-cent piece, which were tender to the touch. Before his sickness, was attending school, was active mentally, thin and spare, wore flannel underclothing, slept up stairs. The water used by the family has been analyzed, and will be referred to again further on. This boy was still sick when I visited Petersburg, but died July 30th, 149 days from date of attack. Other cases were reported by Dr. Gunsolus, so far as related to dates, ages, etc., but the symptoms generally present were not detailed. He mentioned one case as being deaf, and in reply to question stated that he had given the patient no quinine. The disease seems to have displaced the ordinary intermittent and other malarial fevers.

Dr. Paquette of Petersburg says that the first case of his, this spring, had rash and sore throat, and was mistaken for scarlet fever, which was not to be wondered at, considering the great infrequency of occurrence of spotted fever. The patient was a boy, aged about seven years. He was taken sick March 16th, and died in three hours. The next cases, just one month later, were Charles Boone and Ed. Pierce. Both were taken the same night and same hour. Both played at school together. On the day previous they played “snap the whip.” “They had been whirling the Pierce boy,” and he was sick in school the previous afternoon. “He had quite a taste for learning.” He went into a high fever. Had delirium, which lasted about six hours, during which time his pulse was regular and full; after that it was only about 80 beats per minute. Many other cases had intermittent pulse. He had pain at the base of the brain behind, and at the prominent bone in the back of the neck. While in active delirium he worked incessantly at his school studies. Pierce took no quinine, but was deaf. All the worst symptoms in this case afterwards disappeared.

The patients’ mouths were dry, “their nerves ‘taut.’” I think this somewhat singular remark by Dr. Paquette, embodies an important fact. I interpret his observation to be that there was general muscular tonicity, which was increased by any irritation of the skin, because of its increased sensitiveness.

The patients’ bowels were generally costive and hard to act upon. The urine was not passed freely. It was high-colored, some of it coffee-ground color. Nearly every case vomited, not bile, but a substance which looked like

\* Am. Jour. Med. Sci., July, 1864, pp. 138, 139.

† T. H. Squire, M. D., Trans. N. Y. State Med. Soc., 1853.

chopped grass and water. Some of it looked like indigo, and settled in the bottom of a vessel. None of the patients were tender over the right iliac region; they were tender all over the spine, and movements caused pain. Some of them have been spotted; no pimples were observed. The spots were bluish, were evanescent, and disappeared on pressure.

The eyes were frequently affected with squint, generally convergent, but sometimes divergent. They were generally glassy, with a peculiar stare; the lids did not freely raise or lower, they did not wink with natural frequency. The pupils were generally dilated. Dr. Paquette speaks of a purulent discharge from the nose in some cases; but it was his custom to cause the patients to sneeze, and the discharge may possibly be explained by that fact. Dr. Paquette, from whom this part of the account was received, has four boys and four girls. Three of his girls had the disease in rather a mild form. All taken at the same time, and all recovered. His children had not taken off their underclothing. Another girl that died of the disease had taken off her underclothing the day before she was taken sick. An old lady that died had taken off her underclothing two days before she was taken sick. Two of Dr. Paquette's children slept down stairs and one up stairs. Other cases were about equally divided in this respect, so far as I could learn.

Concerning the case which occurred at Deerfield, I have notes made from a conversation with Dr. S. L. Jones of that place. The patient was a male aged about 20 years; had been at school at Adrian; had been complaining for a few days; was taken sick while dancing about 1 A. M., May 13, 1874; he vomited, had a chill and spasms; his head was thrown back; he was delirious; pupils of his eyes were dilated, but contracted under influence of opium; his bowels were torpid; he had tenderness of the spine and muscles; was convalescent in ten days. In Summerfield a little girl aged 7 years "had symptoms similar to ague, headache, and pains all over her, had fits in the afternoon, and died after three hours."

At Dundee, the symptoms, as described by Dr. G. W. Jackson, were as follows: The patients generally complained for about twenty-four hours of being tired and lame, they had pain in the back of the head, in some cases in front part of head. Some complained of pain down the spine, and some of pain in the ears. In some cases there was a cold stage, and in others a distinct chill. Vomiting was a prominent fact during and after the cold stage. A few were taken as suddenly as if knocked down. There was tenderness of the body, superficial, and also over sciatic and other deep nerves given off from spinal cord. The head was thrown back in some cases, and in others it was drawn to one side. There were spots on the skin, generally over the chest. The spots were variable, were the size of the point to that of the head of a pin; were not elevated above the surface, and did not disappear on pressure. The face was flushed and dark. The eyes were affected with squint in some cases, divergent in a few cases. There was sometimes alternate dilation and contraction of the pupils. The dilation was not constant. The temperature was sometimes elevated at first, sometimes below normal. About the highest temperature noticed was 105°. Respiration was irregular. The pulse was frequently almost normal, sometimes slower than natural, but accelerated after a few days. It was frequently intermittent. Before death there was blueness of surface, and small wiry pulse. The tongue was generally covered with a white pasty coating, through which the papilla were sometimes visible. There was



a tendency to a relapse, beginning with a chill which was sometimes repeated. The patients did not sweat of themselves.

Cases of unusual sickness seen by Dr. M. Wilcox of Dundee, presented symptoms as follows: One case, taken sick March 24, died March 31, male aged about 23, taken with congestive chill which lasted about two hours; fever lasted three days; did not vomit; had no spots; face was flushed; pupils not changed; bowels moved readily; urine high-colored and scanty; no tenderness apparent; there was active delirium. Another case, girl aged 11 years, had sore throat, black-coated tongue, had chills at first, and the case terminated in intermittent fever. This patient was tender over spine and back of neck; had pain in back of head; the muscles of back and neck contracted so that the head and feet were only about twenty inches apart. She had diarrhoea part of the time. This case was convalescent in 31 days. Some other cases seen by Dr. Wilcox had spots on the chest about five-eighths of an inch in diameter.

For the characters of the disease as it occurred in the city of Monroe and vicinity I am indebted to Dr. C. T. Southworth, who kindly wrote me concerning it. I quote from his letters as follows: "The cases were not confined to any one neighborhood or street of the city, but were well scattered in the three wards south of the river. The prodromic stage is of variable duration and quality. Some have intermittent fever for a few days, others suffer from tonsillitis, others laryngitis; still others have none at all, the first symptom being a convulsion. The characteristic symptoms do not vary, but the general symptoms may." He speaks of pain in the head, retraction of the head, lock-jaw, and squint as attending nearly all cases, and "paralysis of the lower extremities in four cases." Dr. Southworth mentions "a falling in of the abdominal walls, the abdomen appearing as though it had been dug out or emptied of the viscera. This last symptom I think I have found in every case I ever saw." I noticed this appearance, which was very striking, in a case which I saw at Petersburg. I do not remember to have seen any reference to this subject until Dr. Southworth's letter. In the article on Tetanus in Youatt's "Structure and Diseases of the Horse," page 80, mention is made of "tucking up of the belly, which is seen under no other complaint." This same expression,—“tucking up of the belly,”—is found in descriptions of the Texas cattle disease. In a report of the Sanitary Committee to the Board of Health of New York city, in June, 1874, relative to hydrophobia, then prevailing in that city, this same condition is referred to as one of the characteristics of dogs suffering from that disease. The expression in that case is: "Skin tight on the ribs, abdomen tucked up." There is a certain similarity between the prominent symptoms of these diseases of animals and cerebro-spinal meningitis; and *post mortem* examination reveals anatomical changes which in some respects are similar. May not this retraction of the abdomen be an important expression of a general and characteristic fact in the pathology of these tetanic diseases; that fact being general contraction of muscular tissue, more particularly of the non-striated muscles, involving not only muscular coats of arteries but also of intestines, and possibly including the diaphragm.

Dr. Southworth writes that "the disease did not appear there in 1873, but in 1872 I treated 19 cases in Monroe county, with only one fatal case." In reply to a question as to whether the cereals were affected with smut in that locality, he writes: "Smut prevailed in 1873, none in 1874. I cannot learn regarding 1871." The flour being used at the time of the epidemic in 1874 was probably made from wheat raised in 1873.

The cases of unusual sickness at Blissfield were not all well-marked cases of cerebro-spinal meningitis, but have been included for the reason that they were unusual, and seemed to partake of the character of that disease. I am indebted to H. C. Wyman, M. D., for an interesting account of them, including treatment, and give the main parts concerning one or two of them. A boy, aged 10 years, had not felt well for several days, at night was taken with severe pain in the back of his head, was delirious, had tendency to contraction of the muscles of the neck; there was coldness of the extremities. Mustard was applied to extremities and along the spine. He was said to be better next morning when Dr. W. saw him, but was then unable to bend his head forward, and complained of tenderness throughout the body. His pulse was natural, skin dry, bowels constipated, urine thick and scanty. He had no appetite, was convalescent on the third day. A male, aged 21 years, was never sick a day in his life before, after working in the field all day was taken suddenly with pain in the head and vertigo, vomited, and fell to the ground unconscious. Dr. W. found him in bed suffering severe pain in the right sciatic nerve, was very restless, and sick at his stomach. He had tenderness along the spine; pupils irregular; pulse first trial 88, next trial 100 per minute; temperature 102°. Patient had another paroxysm similar to first, but milder, and was unable to work for two weeks, owing to stiffness of muscles.

#### PATHOLOGY OF THE DISEASE RATIONALLY CONSIDERED.

In a report to the State Medical Society of New York, in 1858, Dr. T. H. Squire remarks as follows: "Neither is it difficult to give a rationale of these manifestations. With the headache, heavy chill, and cold surface, there is violent congestion of the brain; the vomiting and irregular breathing indicates disturbance of the pneumogastric nerve; if there be dilated pupil and loss of sight, they show the nerves of vision to be impaired; when the hearing becomes obtuse, the auricular nerve has suffered; if the sterno-cleido-mastoid and trapezius muscles are rigidly contracted, their congestion or effusion surrounds the spinal accessory; if an arm is convulsed or paralyzed, the difficulty embraces the upper portion of the cord; and in like manner, all the conspicuous symptoms may be explained by the congestion or effusion that exists in the cephalic and vertebral cavities. But having philosophised thus far, it is not so easy to take another step, and account for the congestion, or the inflammation, whichever it may be. The remote cause of this is epidemic, is subtle in its nature, like all other epidemic influences, and makes its impression directly upon the nervous system, without any previous derangement of the blood or the secretions. The exciting causes are exposure to cold and whatever else tends to depress the vital energies of the system. If a neglected child creeps about the cold floor, in wet and scanty clothing, or a delicate boy plays in the snow with damp feet, or a lively school-girl dances and sings till she is exhausted,† or a fisherman wades too long in the river, or a debauchee falls into the canal, they will be quite likely to encounter the disease."\*

#### CAUSE OF CEREBRO-SPINAL MENINGITIS.

Dr. J. Baxter Upham, in the Fifth Annual Report of the State Board of Health of Massachusetts, p. 311, says:

\* T. H. Squire, M. D., Trans. N. Y. State Med. Soc. 1858, p. 168.

† The only case of the disease which occurred at Deerfield during this epidemic, was a young man attacked while dancing at an evening party. Over-work and mental anxiety were assigned in a few other cases.

"The relations of insanitary conditions in and around the abode of the patient to its origin or supposed cause, demands the most careful consideration. In weighing the evidence contained in the returns, I find the scale to be pretty evenly balanced in this particular. The cases are distributed among all classes and grades of society,—the high and the low, the rich and the poor, locations unexceptionable for situation, open to abundant light and air, and the pent-up hovels of the lowly and wretched, have all contributed to the material of the epidemic. We believe, therefore, that the *primal* origin of the disease is atmospheric, and for the present beyond our ken."

Dr. John Simon writes:

"Epidemics have seemed particularly apt to occur in establishments where masses of special population have been living in common domicile,—as in work-houses, convict prisons, schools, and (above all) barracks. And in several such cases the epidemic has seemed to confine itself to one section of the establishment, to one block or building, to one floor, or to one room. It is asserted that, as a general rule, the affected segment of population has been in overcrowded and ill-ventilated quarters. And when the disease has spread from such centres, or has independently arisen among common populations, this, almost always, has been said to have been under similar unwholesomeness of circumstances. Where the epidemic has been among soldiers, officers have enjoyed almost entire immunity; and where common populations have been suffering, the disease has shown great, if not exclusive, preference for the worst lodged classes of the community. \* \* \* In some cases, according to local reports, the distribution of an epidemic has very decidedly not been governed by conditions of over-crowding and ill-ventilation. †

This would seem to show that, although over-crowding and imperfect ventilation may increase the tendency to this disease, it cannot be considered as the essential cause; and it may be that the over-crowding, etc., are only accidental conditions, the real cause being some other condition to which "the affected segment of population" is also exposed. The fact of the disease affecting "segments of population" in the way it does, is evidence against the proposition that it has a general atmospheric cause. Officers may have enjoyed immunity from the disease because their food was from a different source and of better quality.

A distinguished writer says:

"But we may regard it as very probable that epidemic cerebro-spinal meningitis does not depend on atmospheric or telluric influences, but is rather due to an infection of the body with a specific poison." \*

The fact that the disease sometimes prevails in one locality in one year, and in a subsequent year in another place near by, while the place first visited escapes, would seem to be good evidence that the disease is not due to a general atmospheric cause, for if it were, contiguous places should be attacked simultaneously.

In order that the disease may prevail as an epidemic in the way this disease does, and still be due to such influences, it is essential that many persons, of different ages, and of both sexes, shall be more than usually susceptible to such influences, and that such susceptibility shall be restricted to persons within a certain locality, whereas climatic influences are not usually so restricted. In

† Niemeyer's Text Book of Prac. Med., Vol. II., p. 219.

(\* Eighth Report of the Med. Officer of the Privy Council, 1865.) Quoted from Aitken's Sci. and Prac. of Med., Vol. II., p. 455.

short, there seems to be no satisfactory evidence that the disease is due to a general atmospheric cause.

If it is due to any local influence acting through the atmosphere, the nature of that influence remains to be ascertained. The disease has prevailed in localities subject to malarial diseases, but on the other hand it has prevailed in localities not subject to such diseases.

#### IS IT DUE TO THE LOCAL PRODUCTION OF OZONE?

There is, however, one agent which may be formed and added to the atmosphere in greater quantities in some localities than others, and which from its known action upon organic matter may be supposed to be capable of so acting upon the tissues of the body, and of so influencing the nervous system, as to render it possible for changes in temperature and for mental impressions to produce such phenomena as appear in this disease. That agent is ozone. During normal activity of living bodies in our ordinary atmosphere, the tissues of the body are constantly undergoing change through absorption of oxygen and liberation of the products of oxidation. This expenditure of the substance of the body is nominally compensated by a period of repose and repair during suspension of activities in sleep. But if, instead of ordinary atmospheric oxygen, the inhabitants of a given locality are caused to inhale ozone, which is a much more active form of oxygen, it is in harmony with our present knowledge of its properties, to believe that there may result an over-oxidation of the tissues of the body, and that those destructive changes, which under ordinary circumstances are repaired during sleep, may go on to excessive and even to irreparable destruction. It is quite probable that the results of this over-oxidation, if it occurs, would be first exhibited in a disturbance of the nervous system, through a sense of excessive fatigue, of pain throughout the body, which would be increased by movement, and because of over-oxidation of nerve-substance there would be headache, nausea, and vomiting, and finally delirium, coma, and death. Just as occurs in cerebro-spinal meningitis, there would be a greater liability to succumb to the disease by those who overwork, or those who from any cause are depressed in spirits. Thin and spare persons of active minds would suffer most for the reason that they have less oxidizable material in reserve. There would be especial danger to those suffering from fear and anxiety. The disease would probably be neither contagious nor infectious, except through the over-work, mental anxiety, and grief attendant upon a fatal epidemic. There is one fact connected with the pathology of the disease in question that might receive explanation in this connection, that is, the excess of fibrin in the blood, which may be caused in some way through the oxidizing influence of ozone. The greater prevalence of the disease in the spring of the year may be capable of explanation by some facts concerning either the greater production of ozone at this season of the year, or by reason of there being a less consumption of ozone at such time in the oxidation of decomposing animal and vegetable matter. I have been thus particular to mention the supposed possibility of the production of this disease by an excess of ozone in the atmosphere, in the hope of stimulating observations concerning this agent. For several years I have made great effort to obtain a series of observations at different places throughout the State, and if such observations had been generally made and recorded throughout the State, and at the point where this epidemic occurred, it would doubtless have enabled us at this time to have answered this question of its being capable of contributing to the cause of this

epidemic. If the local board of health where this epidemic occurred had performed its duty promptly, and had given notice to this board immediately on the appearance of this epidemic, it is possible that the question might still have been answered at this time, for observation on ozone might then immediately have been begun, even if it required the continued presence of some agent of this board for that purpose. In the absence of evidence as to the relative amount of ozone in the atmosphere of that locality at that time, we can only mention it as possibly contributing, and express the hope that in the next epidemic we may be able to obtain exact information on this point.

#### SOME FACTS RELATIVE TO WATER SUPPLY.

The soil at Petersburg and Dundee is rather loose and sandy. Water upon its surface will pass quite freely through it. Organic impurities may not be so thoroughly removed from water by passing through this soil as through one containing more iron, or more clay through which it would pass more slowly. In this connection it should be stated that at Petersburg the cemetery is within the village limits. I was also informed that the most thickly settled part of the village was once an Indian burial ground. The bodies of those persons who died of unusual sickness just previous to this epidemic and who were said to have presented some of the symptoms of the disease in question, were buried in the village cemetery. The question arose as to the quality of the water drunk by those who contracted cerebro-spinal meningitis.

The first well-marked case which was recognized at Petersburg was Frank Gunsolus, younger brother of a prominent physician of that place. He was taken sick March 3, 1874. The water supply of this family was obtained from a well on the premises. The water was particularly bright and sparkling, was said to be hard, and proved to be on trial, but gave me an impression of being soft water, and I now think it was because of the ammonia which it contained, as shown by the analysis made by Prof. Kedzie, and which will appear further on.

The next well-marked cases at Petersburg, were Chas. A. Boone and a boy named Pierce, both taken in a similar manner, at the same time, April 16th. Some of my notes, respecting the first of these boys, are as follows: Charles A. Boone, aged 12 years; slept up stairs until taken sick; wore flannel underclothing; attended school; was active mentally. The day before he was taken sick he was made dizzy by playing "snap the whip;" was taken sick Friday morning, April 16th; was found about 2 A. M. vomiting and insensible. He was sick for a long time, and presented most of the symptoms usually found in this disease, including dilated pupils, retraction of the head, sensitive skin, great tenderness over spine and large nerves, dark spots, and in this case there was a marked discoloration of the skin over the course of the sciatic nerve, in the left leg, where the skin was exquisitely sensitive and looked as if it were about to slough off. The water used by him and his family for drinking and other purposes, was obtained from a spring on higher ground, but only 7 paces from the opening of two sewers, and 6 paces from a privy in the other direction. This spring was 5 paces from a house, and fifteen paces from the cemetery which is on ground from twelve to fifteen feet higher than the level of the spring. About 18 paces from the spring was a recent grave made May 24th, 1874. Water from this spring was also used by the family living in the house near by,—a rather old man and his wife, who appeared to be in their usual health. The Boone family had not always enjoyed good health since

they had lived here. The cellar of their house was not used, and was not in excellent condition. Mr. Boone informed me that he lately had some difficulty in obtaining good flour; had returned some that they could not well use. I endeavored to secure some of it for examination, but did not succeed in obtaining it. The following communication from Prof. Kedzie contains the facts revealed by analysis of the water from the two sources mentioned.

LANSING, Aug. 20, 1874.

H. B. BAKER, M. D., *Sec. of State Board of Health*:

DEAR DOCTOR—I have analyzed the specimen of water from the spring near the graveyard in Petersburg, and also the specimen of water from the well of Dr. Gunsolus in the same place.

From this examination I conclude that these waters are unfit for domestic use, and may be sources of serious disease in those who make use of them either as potable water or for domestic use. I do not base my conclusion on their physical appearance, for the spring water, while presenting a certain milky appearance at the spring, was bright and clear when it reached me, and the well water was beautifully bright and clear when I received it. The reasons for condemning these waters in a sanitary point of view arise from the chemical reactions which these waters exhibit, as shown in the following statement:

1. These waters contain an abnormal amount of chlorides in solution; the spring water contains chlorides equivalent to 856 parts of hydrochloric acid in 1,000,000 parts of water; while the well water contains 1019 parts in 1,000,000. The soil from which these waters are obtained is alluvial, and we cannot suppose that these chlorides are directly derived from the salt-bearing rocks which yield chlorides so abundantly in some parts of our State. The presence of a large amount of chlorides in water under such circumstances is usually attributed to "sewage contamination" by writers on hygiene, *i. e.*, to the presence of organic matter rich in chlorides.

2. These waters contain an unusual amount of ammonia: the spring water contains one part and the well water seven and a half parts in 1,000,000 of water.

3. These waters contain an abnormal amount of "albuminoid ammonia," that is, organic matter containing nitrogen, and which yields ammonia by putrefaction or by the action of oxidizing agents, *e. g.*, the permanganate of potassium. The spring water yields in 1,000,000 parts  $1\frac{1}{4}$  parts of ammonia, and the well water 1.7 parts of ammonia when treated with caustic potash and permanganate of potassium, after all ammonia ready formed had been expelled by prolonged boiling with carbonate of sodium. This albuminoid ammonia is a most suspicious circumstance, as it reveals the presence of putrescible material in the water.

4. These waters contain a large amount of nitric acid in the form of a nitrate. The spring water contains in 1,000,000 parts 15 parts of nitric acid, and the well water 109 parts. This shows the presence of organic matter containing nitrogen which has become completely oxidized. While the nitrates may not be directly injurious to the human system, yet the presence of so large an amount of nitrates in water which contains putrescible nitrogenous matter is very suspicious.

5. These waters contain a startling amount of nitrous acid in the form of nitrites. The amount in quantity I am not able to state; but when Price's Test (pure Iodide of Potassium free from iodate, acetic acid, and gelatinized starch) is added to these waters without any concentration, they both become *deeply blue*. I never before found natural waters which gave so decided a reaction with Price's test. The presence of nitrous acid or nitrites is accepted by all hygienists as sufficient ground to reject any water for domestic use.

6. These waters contain very distinct traces of phosphoric acid. When a quart of water is evaporated to dryness, the residue dissolved in nitric acid, and excess of molybdate of ammonia added, a distinct yellow precipitate of phospho-molybdate of ammonia is formed. Phosphates are very seldom found in solution in natural waters. The alumina and oxide of iron in soils have so strong an affinity for phosphoric acids, that it will speedily withdraw it from solution by forming insoluble phosphates. That phosphates are found in solution in this water indicates that some organic matter, rich in phosphorus, is undergoing decomposition in such quantity that the soil is not able to completely withdraw it from solution.

The presence in these waters of unusual quantities of chlorides of ammonia, of albuminoid ammonia, of nitrates and nitrites, and finally of phosphates, shows these waters to be very unusual in their composition. We might account for the presence of all these substances if matters very rich in nitrogen and phosphorus, *e. g.* flesh, were undergoing decomposition in their vicinity and the results of this decomposition passed directly into this water. The fact that the spring is near and lies below the level of a graveyard, that the well is in the midst

of an old Indian graveyard, gives much plausibility to this explanation. The fact that the first person attacked with cerebro-spinal meningitis in Petersburg used the water of this well, and that others who used the spring water were attacked with the same disease, would very naturally attract very significant attention to the composition of these waters as having some possible connection with the terrible epidemic which has wasted that village.

Very respectfully,

R. C. KEDZIE.

Grouped in tabular form, the results obtained by Prof. Kedzie, appear as follows:

*TABLE I.—Exhibiting results of Analysis of Water from Spring near Cemetery, Petersburg, Michigan.*

IMPURITIES.	Parts in 1,000,000 of Water.
Hydrochloric acid.....	35.6
Ammonia.....	1.
Albuminoid ammonia.....	1.5
Nitric acid.....	15.
Nitrous acid, as nitrites.....	Unusual amount.
Phosphoric acid.....	Distinct traces.

*TABLE II.—Exhibiting results of Analysis of Water from Well on premises of Dr. Gunsolus, Petersburg, Michigan.*

IMPURITIES.	Parts in 1,000,000 of Water.
Hydrochloric acid.....	101.9
Ammonia.....	7.5
Albuminoid ammonia.....	1.7
Nitric acid.....	100.
Nitrous acid, as nitrites.....	Unusual amount.
Phosphoric acid.....	Distinct traces.

These two analyses were all that were made of drinking-water used by persons having the disease at this place, as they were about the only instances where the persons were still sick with the disease at the time I made the investigation. Frank Gunsolus has since died, after a sickness of some 149 days. When I last heard from the Boone boy he was convalescent. He had been sick about 80 days.

In talking with a gentleman in this city, whose wife was very sick with cerebro-spinal meningitis in the spring of 1873, he said she was taken sick "about the time the water in the well began to be bad in the spring." He was not sick at that time, but his work kept him away from home except at meal-times and nights. At Petersburg, however, several persons used water from the Gunsolus well and the spring near the graveyard, and did not have the disease. There has not yet been sufficient evidence collected on this point to warrant a definite opinion, but it seems quite possible that water containing

certain impurities may predispose persons to this, as well as to other forms of disease; and although healthy adults may sometimes use such water without serious results, it may have been one of the factors in bringing down the Boone boy, who was at the growing age, had eaten food made from bad flour, had an active mind, was using it at school, and took violent exercise the day before his sickness, probably attended with extreme changes in his bodily temperature. It may be that he could have endured any one of these conditions singly, but that taken altogether they made him sick. This was rather a typical case, except that it ended in recovery. Possibly, if other cases could have been studied as closely, a similar group of unfortunate conditions might have been found.

DOES THIS DISEASE DEPEND UPON ANY LOCAL ATMOSPHERIC CAUSE?

Ignoring the possible local influence of ozone, concerning which no evidence could be collected, a careful study of the local conditions actually found in connection with this epidemic, such as those of soil, sewerage, sources of malaria, and general and private sanitary conditions, does not reveal evidence of any influence capable of acting on the human system through the atmosphere, and which appeared to be so different from those in other localities where this disease did not exist, as to warrant the belief in its being the cause of this epidemic.

In this connection, there is one point which should receive attention hereafter. It was noticed in New York city that in the epidemic of 1872 the disease was at first almost entirely confined to original water courses. In studying the disease as it has been reported in the Vital Statistics of this State, I find that it is found more particularly in localities through which streams run. The epidemic of which this is a report occurred in villages situated along the bank of the River Raisin. Many of the inhabitants are inclined to attribute the disease to some influence from the river. If it was due to any such cause, it must have been one which does not ordinarily exist there, as this disease is extremely uncommon in that vicinity. There is one fact which may possibly be found to have some bearing upon the subject, so far as streams are concerned: it is that tons of the refuse from wheat ground at the various mills are annually thrown into the river. It is called "smut," but in ordinary seasons it consists largely of the fine velvety material from the small end of the kernels. In the year preceding that in which the disease prevailed along this river, the wheat and other grain raised in that vicinity was more than usually affected with what is called "smut," and the refuse from such wheat would contain vast numbers of the spores of the so-called smut,—a fungus known as *Tilletia caries*. Some of the mills were running during the winter and early spring months,—that was true of one at Norvell,—but as soon as spring fairly opened there was undoubtedly a great deal of this kind of organic matter present in the river water. It probably tended to collect in the sluggish bayous along the river banks, and as the warmer weather arrived it may have undergone decomposition and yielded a poisonous vapor to the atmosphere, or the living spores may have germinated. Milch cows may have drank it,—and they probably did so,—possibly with safety to themselves, but to the detriment of those who used their milk. These conjectures are all that can be brought forward now, as no knowledge of the epidemic came to this board until it was nearly over. But, given the two facts stated above, and the hypotheses are at



once suggested as of sufficient importance to warrant further examination, if, as is altogether probable, another epidemic shall give the opportunity.

This brings up another question somewhat closely related to this last. It is:

CAN THIS DISEASE BE CAUSED BY MILK FROM COWS FED ON POISONOUS FUNGI?

Edible fungi are sometimes poisonous when their spores are ripened. A case occurred in Scotland:

"Not long ago the Pharmaceutical Society in Edinburgh was promised a lecture by Mr. Sadler on edible and poisonous fungi, but when the evening came Mr. Sadler was ill. \* \* While preparing his lecture for the Pharmaceutical Society he accidentally swallowed a great quantity of the spores of a large species of puff-ball (*Lycoperdon Giganteum*), and within the space of an hour and a half was seized with severe illness, accompanied with violent pains. The violent symptoms were not subdued until nine days after the first attack. Sir Robert Christison, Dr. Balfour, and Dr. William Craig, who attended Mr. Sadler, were of the opinion that the continued irritation was kept up by the fungus spores. The giant puff-ball is edible in its young state, but its matured spores ought certainly to be avoided." \*

It is well known that cerebro-spinal meningitis occurs most frequently in the winter and spring. At such seasons milch cows are fed largely on hay and ripened grain, while in summer their food is green, and, as a rule, spores of fungi may not be so generally ripened as in the winter and spring food. Whenever another opportunity is offered, it is to be hoped that the milk used by those who contract the disease will receive thorough microscopical and chemical examination, and that the food of the animals from which it is obtained will be closely examined. Mouldy hay would of course have thoroughly associated with it the spores of the particular fungus of which the mould consisted, and even these common moulds have been charged with poisoning.

Dr. M. L. Holbrook says:

"Johier has signalized the poisoning of three animals which had eaten mouldy bread. Westerhoff has made known the case of two children who had taken rye bread containing the *Mucor Mucedo*, the most common species of mould." †

Binding "rusty" straw is said to occasionally cause sickness.

Dr. Salisbury of Ohio claimed at one time that a disease something like measles could be produced by some fungus connected with straw.

Pavy mentions the production of diabetes by inhalation of spores in the dust of a "puff-ball." He has further found that "through the agency of the inhalation of puff-ball smoke an immediate and strong diabetic state may be induced, and that the effect is accompanied with such a modification of the circulation that the blood flows through the vessels as is the case after section of the sympathetic, without becoming properly de-arterialized. His experiments, he considers, suggest that in diabetes of the human subject, the blood, in consequence of vaso-muscular paralysis, is allowed to reach the portal vein in an imperfectly de-arterialized condition, and thus determines the escape of sugar from the liver." ‡

\* Boston Jour. of Chemistry, Aug., 1874, p. 24.

† Page 134, "Eating for Strength."

‡ Lancet, Aug. 29, 1874. Quoted in "Medical News and Library, Oct., 1874, p. 156.

## HOW DO FUNGI DESTROY ANIMAL AND VEGETABLE LIFE?

Without attempting to answer this difficult question, it may be proper to make a few suggestions regarding some of the possible methods of action of some fungi. Omitting, for the present at least, anything more than a reference to the directly poisonous action of the substance of some of them, by its action on the nervous system, the spores of some fungi, and perhaps the particles of germinal matter of which the spores are composed, may, and by some who have studied the subject are believed to be, capable of inducing changes within organisms analogous to those changes occurring outside of organisms which result in the production of the various alcohols, of vinegar, etc., etc., which are formed at the expense of more highly organized matter through a conversion of a part of it into the proper substance of the fungus. The same idea is applicable to those low forms of organic life which cause, or at least attend, those putrefactive changes in animal matter which liberate hydrocarbon or sulpho-hydrogen gases. These latter changes are believed to be connected with the presence of the lower forms of organic life, and the first-mentioned are accepted as resulting from a specific *vegetable* ferment in each particular case. Judging from the foregoing, taken in connection with the phenomena of the disease, we might expect to find that typhoid fever, for instance, may be caused by a low form of life capable of acting as a ferment or of reproduction at the expense of more highly organized matter. Remembering the peculiar "intoxication" in cerebro-spinal meningitis, we might also suspect that this disease, as also cholera, may be produced by a ferment or ferments of vegetable origin and character.

This is but an imperfect reference to a part of the subject which seems worthy of examination, but it was thought best to call attention to it, especially as this disease has been classed among zymotic diseases.

## IS THIS DISEASE DUE TO INFECTION, BY MEANS OF FUNGI?

When certain fungi are found present in certain diseases, the question then arises whether they are the cause of the disease, or are dependent upon the diseased condition for a suitable soil in which to exist. This question seems to be already answered for some diseases. In small-pox, for instance, the condition requisite for the reproduction of the virus through implanting it in the system is not one of disease. The person must not only not be sick with small-pox, but must not have had the disease for some considerable time past. This is characteristic of the ferments. A ferment added to a solution which has just completely undergone the particular fermentation dependent upon such ferment produces no marked effect; but if added to a solution which is not fermenting, and has not undergone such fermentation, if the solution contain material capable of maintaining such fermentation, it will go through such changes if under suitable conditions of temperature, etc. The uniformity with which these phenomena present themselves is so generally understood as hardly to require proof. Every housekeeper who raises bread with yeast can certify that the fermentation appears to depend upon the *yeast*, and that the quantity of yeast is increased in this way. Knowing this uniform mode of action of ferments, whether within or without the body, the explanation of the regular course of the contagious diseases and of the reason why they do not, as a rule, appear but once in the same person, does not seem difficult to understand. Now that we know this characteristic action of ferments, and know that the virus of vaccine and of small-pox consists of "living and inde-

pendent organisms, belonging to the smallest and simplest of all living things, which multiply, without the formation of mycelium, by cell-division alone, and perhaps by the production of resting-spores,"\* it seems reasonable to expect that the other contagious or infectious self-limited and self-excluding diseases will also be found to depend upon the introduction into the system of a particular ferment which causes each disease, and that thorough and systematic search will reveal the precise nature of each one of these special ferments. As regards that of small-pox, "according to Dr. Cohn's observations, these corpuscles are single cells of a spherical form, not more than one twenty-five thousandth of an inch in diameter. They belong to the genus *Micrococcus*, and those of the vaccine lymph are designated by the name of *Micrococcus Vaccinae*. They increase in numbers if kept at the temperature of the living body, forming chains and groups of associated articulations."†

There is additional encouragement in the search for these specific ferments; in the fact that already "another kind of micrococcus has been described by Dr. Oertel of Vienna, and by Prof. Ebert of Zurich, as constantly present in cases of diphtheria; and both observers have found that its inoculation in different parts of the body in healthy animals produces a diphtheritic malady having its starting-point at the place of inoculation."†

The existence of fungi or other parasites as the cause of disease is not necessarily negated by the fact of a disease being continuous. The *Achorion Schonleinii* is capable of continuously maintaining itself and thereby the peculiar disease known as favus. It seems probable that in order that diseases dependent upon fungi shall run a definite course and protect against future attacks, the fungus must undergo its changes in the blood of the patient, and the disease be a general one, causing a change throughout the whole organism. In cerebro-spinal meningitis the disease seems to be dependent upon some blood-poison and, considering the usual phenomena of fermentation and of diseases dependent upon special ferments, it would seem that a very important question to be asked in the study of the cause of this disease, is as to whether it both runs a regular course and is protective against future attacks of the same disease. Although individual cases of cerebro-spinal meningitis present considerable variations, there still appears to be a greater tendency to death at certain stages of the disease, and a certain change in the symptoms of the disease after a certain period in its progress. But this alone, without protective influences, does not indicate whether or not the disease is due to a specific ferment, for the symptoms may be the same whether the blood-poison be a ferment or a simple mineral or vegetable poison. On the question of protection against future attacks of the same disease, it seems almost impossible to obtain any data, for the reason that the outbreaks of this disease occur so erratically. One might nearly as well inquire whether lightning ever strikes twice in the same place. Without this kind of data we lack important evidence of its being caused by a specific ferment. Inasmuch as no such ferment has ever been discovered in connection with this disease, we must conclude that we have not as yet satisfactory evidence on this point. Unless it can be proved that the disease is due to an ordinary poison, it is to be hoped that observers will endeavor to collect evidence of its protective influence, and search

\* Dr. Cohn, quoted by Prof. John C. Dalton, M. D., in Address on the Origin and Propagation of Disease, Am. Chemist, Apr., 1874, p. 880.

† Prof. J. C. Dalton, in Address on the Origin and Propagation of Disease, Am. Chemist, April, 1874.

for the presence of a specific zymotic cause. Evidence as to its communicability by infection should also be sought for.

FEAR is frequently an important element in the causation of spinal congestion. The following evidence bears upon its influence in this disease: Dr. Gunsolus of Petersburg tells me that Mr. Gradolph was very apprehensive on the subject of cerebro-spinal meningitis during its prevalence there. His brother-in-law,—Mr. Harvey,—also expressed fear that he should contract the disease. One little girl more than once went home from school to her mother, and, putting her hands up to her mother's face, said, "I am not feverish, am I mother? I am not going to have the fever." Another little girl, some time before coming down with the fever, said she knew she should have the disease,—she was sure she should catch it. All these persons contracted the disease and died. It may be that in such cases the fear is partly due to effects of the poison of the disease not yet sufficiently powerful to produce its full effect; but there can be no doubt but that fear is capable of causing serious disturbance in the circulation, and it may be, and probably sometimes is, a factor in the cause of this disease.

Just how such impressions upon the nervous system tend toward the production of this disease may be made to appear more evident further on, after studying some more powerful exciters of vaso-motor nerves.

#### SEASON OF YEAR.

Dr. Aitken, in his *Science and Practice of Medicine*, says:

"Of 182 European epidemics, 24 were in October and November, 46 in December and January, 48 in February and March, 30 in April and May, 24 in June and July, and 10 in August and September (Simon).

The outbreaks in this country have been chiefly during the winter and early spring. In Sweden, of 417 local outbreaks, 311 were in winter and 106 in summer. Of 85 epidemics in Europe and the United States, noted by Hirsch, 33 prevailed in winter, 24 in winter and spring, 11 in spring, 1 in spring and summer, 2 in summer, 1 in summer and autumn, 1 in autumn, 1 in autumn and winter, 3 in autumn, winter, and spring, and 6 throughout the whole year."\*

The epidemic concerning which this is a report, occurred in the spring of the year.

Difference in temperature is perhaps the most prominent fact connected with the seasons of the year. But because a large proportion of epidemics occur in winter and spring it does not necessarily follow that they are due entirely to the temperature. The food is somewhat different at different seasons, and there are other conditions which cannot properly be ignored, although temperature may be considered first.

#### COLD AND CHANGES IN TEMPERATURE.

Is this disease due primarily to some external influence exerted upon the nervous system? Of such influences, heat and cold are among the most prominent. It is believed that the influences of heat and cold are sufficient to cause spinal anæmia and spinal congestion. It is claimed, but not proved, that these influences in connection with a wound are sufficient to cause tetanus. In some respects these diseases are similar to the one in question. There is, however, a general belief that something more than unusual conditions of heat

\* Vol. II., p. 455.

and cold are required for the production of epidemic cerebro-spinal meningitis.

But temperature is a subject too important to be dismissed without an effort to learn the nature of its action upon the living body. Can the nature of the action of cold be explained?

Cold is one of the causes to which tetanus is attributed. Torticollis (wry neck) is believed to result from exposure of the part to cold. Most people who, during a cold winter day, have ridden a long distance, exposed to a cold atmosphere, in an open vehicle, have also experienced a peculiar stiffness of the muscles of the neck, with more or less difficulty of turning the neck from side to side. Swimmers are quite frequently taken with cramp while exposed to the influence of cold in the water. The action of cold in contracting the surface of the body, making it to appear like "goose flesh," is well known. Living human tissue subjected to extreme cold, is comparatively pale and bloodless. From this grouping of facts, it would seem that one prominent action of cold is to cause tonic (tetanoid?) contractions of muscular tissue; and this action is not confined to non-striated muscles. This appears to be the explanation of the phenomena mentioned above.

The fact that such muscular action is caused by cold is important, and should not be overlooked in studying the cause of this disease. Tetanoid contractions are so common in this disease that it has been proposed to change the name to "Tetanoid Fever." We see from the foregoing that, within the limits of our ordinary experiences, cold is known to produce cramps and contractions which are essentially tetanoid. The subject of tetanoid contractions will be studied more at length in another part of this paper. The following facts in physiology and anatomy may also be profitably considered in this connection, as also for their bearing upon the subject of disturbance of the circulation in cerebro-spinal meningitis.

"From all of these observations, and others of the same kind which we have not thought it necessary to quote, the existence of vaso-motor nerves and their connection with centres in the cerebro-spinal axis are sufficiently well established. It is certain, also, that centres presiding over particular functions may be located, as the genito-spinal centre, in the spinal cord opposite the fourth lumbar vertebra, and the cilio-spinal centre, in the cervical region of the cord, both described by Budge. A stimulus generated in these centres, sometimes as the result of impressions received through the nerves of general sensibility, produces contraction of the non-striated muscular fibres of the iris, vasa deferentia, etc., including the muscular walls of the blood-vessels. The contraction of the muscular walls of the vessels is tonic; and when their nerves are divided relaxation takes place, and the vessels are dilated by the pressure of blood. By this action the local circulations are regulated in accordance with impressions made on sensory nerves, the physiological requirements of certain parts, mental emotions, etc. Secretion, the peristaltic movements of the alimentary canal, the movements of the iris, etc., are influenced in this way."\*

As shown in the foregoing quotation, the circulation is controlled through the influence of vaso-motor nerves, and "local circulations are regulated in accordance with impressions made on sensory nerves," etc. It may thus be understood how cold may powerfully influence the circulation. We may

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\* Flint's Physiology, Vol. IV., pp. 433-9.

notice in passing that Prof. Flint says, "the movements of the iris, etc., are influenced in this way," that is, through the same system of nerves which controls the circulation. Disturbed movement of the iris, particularly dilatation, is a common occurrence in this disease. One fact relative to the circulation in this disease is that the pulsations of the heart are sometimes lessened in frequency, a condition not usually found in other fevers, and which may be due to irritation of the pneumogastric or the spinal accessory nerves.

"All that can be said, in the present state of our knowledge, is, that the pneumogastrics have a direct inhibitory influence on the heart. When they are divided and the heart removed from their influence, the pulsations become more rapid. When the peripheral ends of the divided ends are galvanized the heart beats more slowly, or its action may be arrested by a current of sufficient power. This action may also be reflex, due to an impression conveyed to the centres by what have been described by the brothers Cyon and Ludwig, as the depressor nerves." \*

"When the central ends were stimulated in dogs the pupils became dilated, the eyes protruded, sometimes vomiting occurred, and always the number of respiratory acts was diminished, and, with a powerful current, were arrested in inspiration; but the pulsations of the heart were not affected." †

If the phenomena attending irritation of both extremities of this nerve be grouped together, more of the phenomena sometimes present in cerebro-spinal meningitis appear than when taking them separately. In the living person, any stimulation of such nerves at their roots or near the medulla oblongata would be equivalent not simply to stimulating either the peripheral or central ends, but both peripheral and central ends. This bears more particularly upon a part of the subject treated of further on, namely the influence of substances in the food which may enter the blood, act upon the vaso-motor nerves to control the circulation, and, by so doing, cause serious damage to the cerebro-spinal nervous tissue. But these considerations also have a bearing in this connection; for it seems that the circulation may also be influenced by cold; and in this connection I desire to call attention to a fact which may be of importance as an aid in appreciating the manner in which cold may cause serious trouble. This fact is, that when a person is exposed to a cold atmosphere nearly every part of the body is protected by warm clothing, but *the cold atmosphere is inhaled into the lungs at every breath*. This is also true at night, when a person is sleeping in a warm bed in a cold room. It is an important question which remains to be proved, whether or not this fact has any necessary connection with such other facts as that epidemics of cerebro-spinal meningitis occur more frequently in cold weather, that persons affected with the disease complain of pain in the back of the head and neck, which pain is increased by movement of the neck, especially forward, that the pupils are dilated, and that in the beginning of the disease vomiting is a frequent occurrence. Some of the prominent phenomena of this disease, such as tetanoid contractions of the muscles, are such as may be accounted for by the influence of cold, while some of the other phenomena would be accounted for by irritation of the pneumogastric nerves. These nerves are distributed mainly to the lungs, the heart, and the stomach. Cold air taken into the lungs would furnish both the conditions just mentioned.

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\* Flint's Physiology, Vol. IV., p. 233.

† Flint's Physiology, Vol. IV., p. 233.

That cold is one of the causes of this disease appears probable. That it is the most important cause seems improbable. If it were, the disease should appear in every cold season. It does not; and what is more, it sometimes appears in summer and autumn, in seasons when cold could not be supposed to account for its prevalence.

#### DRYNESS OF THE ATMOSPHERE.

In a brief sketch of this disease as it appeared in Livingston Co., Mo., in the winter of 1861-2, Dr. T. F. Prewitt mentions (*St. Louis Med. and Surg. Journal*, May and June, 1865,) that it "first made its appearance among the soldiers stationed at Chillicothe, during an unusually severe and protracted spell of dry cold weather." \*

In speaking of the epidemic which began in New York city about the beginning of the year 1872, Dr. Moreau Morris says:

"In this connection, with reference to the present epidemic, an investigation of the meteorological conditions immediately preceding its outbreak exhibits the fact that, during the last three months of 1871 and the first three months of 1872, there had been comparatively with the corresponding six months of ten previous years, a very unusual and marked dryness of the atmosphere; and when we remember that this disease began to develop coincident with the lowest point of humidity, and rapidly increased during that dry state of the atmosphere, we may, perhaps, recognize an element having a most important bearing upon the question." †

This subject should receive attention. It may turn out, however, that the dryness as well as the disease is closely connected with extreme cold, and in a great degree dependent upon the temperature.

#### POISON IN FOOD AS A CAUSE OF THIS DISEASE.

Next to atmospheric influences, the most constant and controlling in their action are those of food and drink. A careful study of the literature of this disease makes it apparent that it has at various times prevailed, under very different circumstances, in localities subject to malaria, and in those not subject to it, in one locality at one time and in another near by at another time. The evidence is not conclusive that it is contagious; it attacks persons of both sexes and at all ages. Now some injurious article of food, or some temporary quality of the water supply of a locality might account for this irregular appearance of the disease.

Taking up the question of food, we know that frequently the main articles of food of a given locality are the same for a large proportion of the inhabitants. The flour that supplies a locality with material for its breadstuffs is generally supplied in considerable quantities from one source. Any poisonous ingredient in it would be distributed to all persons alike, leaving those most susceptible to its influences to suffer most.

There are certain facts connected with outbreaks of the disease in foreign countries which point strongly to some poison in the food as the cause of epidemic cerebro-spinal meningitis. Dr. J. Netten Radcliff says: ‡

"During the outbreak in France in 1837 and following years, the ravages of the malady were principally confined to certain garrisons, and even to small

\* *Am. Jour. Med. Sci.*, p. 278.

† Report, Board of Health of New York City, 1871, p. 854.

‡ *Epidemic Cerebro-Spinal Meningitis*, by J. Netten Radcliffe.

sections of a garrison, without affecting the surrounding population. A like limitation of the disease to certain detachments of troops was observed during the recent war in the United States; and the restriction of the malady to small portions of workhouse populations, as in the first outbreak in Ireland, is an analogous phenomenon." "In France, from 1838 to 1848, the disease re-appeared again and again among the forces in Bayonne, Versailles, and Avignon, *notwithstanding changes of garrison.*" "During 1837 and 1838 the garrisons of Bayonne, Dax, Bordeaux, Rochefort, and La Rochelle suffered. From 1838 to 1841 the disease was prevalent among the garrisons of northeastern France, particularly those of the valley of the Rhone. Thus it broke out at Toulon, Marseilles, Aigues-Mortes, Nismes, Avignon, and Pont-Saint-Esprit. In the course of the four years, 1839-40-41-42, the malady appeared in succession among the troops occupying the fortresses of Strasburg, Schelestadt, Colmar, Nancy, Metz, and Givet." "From 1839 to 1842 [*same years as above*] it prevailed among the forces at Versailles, Saint Cloud, Rambouillet, and Chartres." "Those stationed along the coast of Brittany, at Brest, L'Orient, Nantes, and Ancenis, suffered in 1841; and during 1840 and 1841 *the disease manifested itself among divers detachments of a regiment scattered at Laval, Le Mans, Château-Goutier, Tours, and Poitiers.*" "In 1840 *it broke out among the French garrison at Donera, Algeria,* and during the next seven years it attacked numerous towns and localities of the province, affecting the civil population, both European and native, as well as the military." "During 1849 and 1850 the disease was prevalent to some extent among the French troops in Italy."

Speaking of the outbreak in Ireland in 1866, the same writer remarks:

"It is noteworthy that, as in the earlier outbreaks in France, the military in Ireland, in proportion to their strength, suffered prominently from the disease. In some of the country districts cases were recorded among the troops alone, or among persons in immediate connection with them." "In January and February, 1867, an outbreak of a disease characterized by severe rigors, tetanic convulsions, intense neuralgic pain in the head and upper part of the trunk, increased sensitiveness of the surface, obstinate vomiting, restlessness, and, in one instance at least, by a dark purple eruption, but of which not a single case died, took place at Bardney, in Lincolnshire, a village about ten miles east of Lincoln, on the verge of a fen country, and having a population of 1,500, the bulk of whom are engaged in agricultural pursuits."\*

One can hardly study these facts without coming to the conclusion that in the cases mentioned the disease as it occurred in the armies was produced by some article of army supply furnished to troops. There would not be likely to be any peculiarity of the water supply which should affect troops so much more generally than the surrounding population. Atmospheric influences would not be likely to be so restricted, except through defective ventilation, and this does not seem capable of explaining all the epidemics that have occurred, particularly as it occurs in localities where the ventilation is the same as previously, and as after the disease has disappeared. The disease does not appear to be contagious, and the evidences exhibited of infection of localities are not prominent except as connected with troops. It seems probable that the disease was caused by some article supplied to the troops, only in those years, or which only had deleterious power sufficient to cause the disease in those years. Unless evidence can be produced of some unusual supply to the troops

\* Quoted from "Epidemic Cerebro-Spinal Meningitis," by J. Netten Radcliffe, as are preceding statements of epidemics among garrisons.



at that time, it remains to conclude that the cause was perhaps due to some temporary quality of the usual food. This would be a cause capable of explaining the facts, and no other cause which has been suggested would so well account for all of them. Some of the prominent facts relative to the epidemic just mentioned may be briefly recapitulated as follows: In France, in Ireland, and in the United States, at different times, the disease was principally confined to garrisons and detachments of troops. In the years 1837 to 1842 the disease attacked the French troops, and in two instances while serving abroad. In one instance, also, the troops of a particular regiment suffered, although scattered about in different localities. Now it is quite probable that the commissary supply of that regiment may have been the same for all its several detachments, and quite possible that it was in part the same as furnished to those garrisons and detachments at home and abroad, which suffered from this disease. In order that this should be true, however, the article causing the disease must have been one which was uniformly used in small quantities, purchased in large quantities, or one which was the product of some crop which was affected throughout wide areas of production, as, for instance, the wheat crop, which may have been unusually affected during those years, in which case a larger proportion of affected grain may have found its way into the breadstuffs supplied to the troops than was retained by the agriculturists for their own use.

If those epidemics in France in the years 1837 to 1842 were due to such a cause, it is somewhat singular that they were not traced out at the time, for I find accounts of several serious epidemics which in times long past have occurred in France and in other countries, and which were believed to be due to ergotism; and on page 486, Vol. I., Chapman's *Therapeutics*, published in 1825, the author says: "It has been a generally received opinion in Europe for a century or two, that bread made of grain vitiated in this way, occasions diseases of a very extensive and violent description. Of these, however, the most common is a species of dry gangrene, pervading at the same time entire districts of country." In a footnote referring to the possibility of such diseases being caused in this manner, the same author says: "This is no longer doubtful. By a series of well-conducted experiments, Dr. Charles Byrd has shown that pigs, ducks, and fowls, eating for a week or two food containing the ergot, acquire a gangrenous state by which the former lose their hoofs and the latter their bills, etc. These experiments are contained in his *Inaugural Essay*, 1821." On page 628 of Coxe's *American Dispensatory*, published in 1831, is an extract from this same inaugural essay of Dr. Charles Byrd of Virginia, giving some further details of his experiments. He says: "From the results of my own experiments, I am led to the certain conclusion that the ergot is capable of producing the dry gangrene; but at the same time I am convinced, and indeed the fact is mentioned by M. Bossau that the gangrene is not always of the dry kind, which certainly is proved by my last experiment." In the extracts from this essay which I have found, the prominent symptoms of cerebro-spinal meningitis do not appear, but this experimenter seems to have been looking mainly for certain symptoms which had been mentioned in connection with this cause, and he may have overlooked many of the actual results. In fact it is certain that he either overlooked some of the results, or the poison is capable of producing different effects under different circumstances. His experiments were with animals. The effects of ergot of rye on human beings are stated on page 382 of the *U. S. Dispensatory* of 1870,

as follows: "In the quantity of half a drachm or a drachm it often occasions nausea or vomiting, and in still larger doses produces a sense of weight and pain in the head, giddiness, dilatation of the pupils, delirium, and even stupor." Now these, so far as they go, are precisely the symptoms exhibited in cerebro-spinal meningitis.

In an article on Epidemic Cerebro-Spinal Meningitis, by J. Netton Radcliffe, in J. Russell Reynolds' System of Medicine, I find the following:

"*Diseased Grain.*—Dr. B. W. Richardson has suggested that epidemic cerebro-spinal meningitis may possibly arise from the consumption of diseased grain, after the manner of ergotism, and perhaps acrodynia. He thinks the probabilities are altogether in favor of the suggestion, that 'the cause, in fact, is a diseased grain, or fungus, contained in some kinds of flour out of which the breadstuffs are made. This fungus may not be present in large quantities, and many persons may eat of the food without getting a poisonous part; but one will get it out of a number, and this without any communication beyond the breaking of bread together. The disease may occur in one member of a family, leaving the rest free; and in this irregular way it may be distributed in an epidemic form over a large surface of the country.' He adds: 'If my hypothesis, as regards cause, be correct, there is little danger of the disorder extending widely in this country; for of our cereals used as food, nearly the whole of the population now select wheat, and our wheat generally is selected for the market with great judgment and circumspection. Any cases, therefore, that might occur would be isolated, and would be easily traced out and prevented.'<sup>1</sup> This suggestion opens out an altogether new field of inquiry respecting the origin of the disease, and it demands active and thoughtful consideration in subsequent outbreaks. Dr. H. Day of Stafford has endeavored by experiments on the lower animals to obtain some light on the subject. He fed three rabbits with unsound grain (wheat, oats, ergot of rye, and mouldy bread) with this result: In all the animals a spasmodic affection was produced, and in two inflammatory changes in the right eye, proceeding in one case to ulceration of the cornea and evacuation of the contents of the globe. One of the rabbits died on the eighth day, the other two were killed on the twelfth day, and in all more or less congestion of the membrane of the spinal cord was found on dissection.'<sup>2</sup>

#### SOME EFFECTS OF ERGOT.

The following quotation from Wood's Therapeutics, is a description of some of the effects of ergot; but omitting such words as "dose," "drachm," etc., it might well pass for a description of the symptoms present in many mild cases of cerebro-spinal meningitis. It should be borne in mind that the author is describing the effects of ergot in doses insufficient to cause death:

"If the dose be increased to half a drachm or a drachm it will, in both sexes, occasion some degree of nausea, and more or less cerebral disturbance, attended, generally, with some diminution in the frequency and force of the pulse. In still larger doses, of from one to two drachms or more, it evinces decided narcotic properties. With nausea and a disposition to vomit, and sometimes actual vomiting, there are now dilatation of the pupils, giddiness, a feeling as of intoxication, heaviness or pain in the head, and not unfrequently more or less drowsiness or stupor. Sometimes irregular and involuntary

<sup>1</sup> Social Science Review, May, 1865, p. 408.

<sup>2</sup> Clinical Histories and Comments, pp. 18-23.

muscular contractions have been noticed; but they are not common symptoms. The dilatation of the pupil is an ordinary phenomenon. It is usually, however, moderate, and unattended with disorder of vision. Sometimes the bowels are disturbed, and evidences of gastro-intestinal irritation or inflammation are said to have been presented in some instances; but this is certainly not a necessary or even common result. Sensations of itching, numbness, or fatigue, are occasionally felt in the limbs. The circulation is usually depressed, and sometimes greatly so. In female subjects, the uterine contractions are induced much more quickly than the nervous symptoms here described, and do not continue so long. What dose would be sufficient to prove fatal in man has not been ascertained; nor can I find that any instance of death has been traced to a single dose, however large.”\*

ERGOT HAS BEEN USED AS A REMEDY.—MAY IT BE A CAUSE OF THE DISEASE?

Ergot has been recommended and used for the treatment of this disease, and it is believed by some that it is useful for this purpose. This being true, it is quite probable that some will be inclined to reject, without any examination whatever, the idea of the disease being caused by ergot or by a fungus similar to ergot. It may therefore be worth while to show that, instead of being opposed to such idea, the fact may, possibly, be explained in a way to support that view.

It is well known that after the long-continued application of cold to the human body it is entirely unsafe to allow the body to be subjected to the action of heat, even that borne under ordinary circumstances. In the case of chilled fingers, it is considered good practice to apply snow, and, afterwards, cold water, and only to allow the temperature of the part to increase very slowly, in order to avoid too violent reaction, which has been found dangerous. We may also bear in mind the proposition that “action and re-action are equal and opposite.”

Cold is believed to cause the contraction of non-striated muscular tissue, and thereby lessen the calibre of the blood-vessels and the supply of blood to the parts. The influence of heat in an opposite direction is well known. Heat and cold have been recognized as sufficient to cause spinal congestion. From what we know of such influences in other parts of the body, we may assume that alternations of heat and cold would be a much more efficient cause. If there were brought to us a patient whose whole body had been subjected to extreme cold, we would expect that his nervous system, or other tender parts of his body, would be in great danger if we immediately allowed him to be subjected to the influence of heat. We would expect the best result from the application, at first, of cold, that is, compared with normal temperatures.

Ergot is also believed to cause contraction of the non-striated muscular tissue of the body generally, as it is known to do in the uterus, and as it does in the blood-vessels when it restrains hemorrhage. Now it seems quite possible that the long-continued use of flour made from ergotted rye or smut wheat may produce a condition of the system somewhat analogous to that produced by extreme cold, and that whenever a person previously subjected to such food is suddenly exposed to heat or any other such influences as tend to relax non-striated muscular tissue, that person is in danger from congestion, and espe-

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\* Wood's Therapeutics and Pharmacology, Vol. II., pp. 693-9.

cially from congestion of those parts which soonest feel the influence of such relaxation. It *may* be just as dangerous to suddenly withhold ergot, after its long-continued use, as it is to suddenly expose a person to heat after long-continued exposure to cold; and, possibly, for very much the same reason.

That ergot has seemed to be useful in certain stages of this disease does not therefore necessarily weaken, but it may rather strengthen the view that the disease may be caused by a similar fungus.

A large number of epidemics of cerebro-spinal meningitis occur,—as did the one reported in this article,—in the spring of the year, when we have a cessation of the cold winter weather. It is also well known that ergot loses its power by age, and it is possible that the same flour which has during the cold weather contained ergot or smut of rye, buckwheat, or wheat, in an active form, may as spring comes on lose some of its active power over non-striated muscular tissue. If this should be found to be true, then the explanation of the manner in which this disease might be caused by ergot would not be much more difficult than the explanation of congestion resulting from sudden exposure of a part to heat that had previously been subjected to cold. In the spring of the year the influence of heat following cold would be added to the other cause or causes more generally than at any other season of the year, except perhaps in winter, when the cold is usually present out of doors and the heat indoors, and alternations of temperature are as rapid as the passage from one place to the other. This may account for the fact that epidemics of this disease have been most frequent in the first half of the year.

There is another fact capable of a similar explanation. That is the frequent onset of this disease during sleep. In studying the epidemic at Petersburg this fact was more than once mentioned, and in looking over histories of cases elsewhere I have frequently observed that the first knowledge of the disease appeared at night, after the person had retired, the patient being awakened by nausea or vomiting, or being found in distress by others. Here the influence of a warm bed would be one element in the case; the position of the body is another, and, it may be, a stronger one. "In the recumbent posture on the back, the blood gravitates in large amounts to the spinal vessels." \*

And, again, the relaxation of tissue in sleep, dependent upon suspension of active stimulation of the cerebro-spinal system of nerves, probably favors that stagnation of blood from diminished tonicity of the blood-vessels, whether caused by heat following cold, or by a lack of other accustomed stimulus to their muscular walls, such, for instance, as might result from a change from the use of food containing ergot to that containing none.

Prof. Flint says: "The contraction of the muscular walls of the blood-vessels is tonic; and when their nerves are divided, relaxation takes place, and the vessels are dilated by the pressure of blood." \* \* \* "The vaso-motor filaments are not confined to the branches of the sympathetic, but they exist as well in the ordinary cerebro-spinal nerves." †

The foregoing is offered in order to induce certain persons to investigate this subject. To the writer it seems fully as probable that the disease may be caused by the direct action of ergot or other fungi, in conjunction with cold, as will appear further on. There are, however, at least two classes of cases.

\* Diseases of the Nervous System—Hammond, p. 392.

† "Physiology of Man," by Austin Flint, Jr., M. D., p. 489.

## THE PRODUCTION OF TETANOID CONTRACTIONS.

One of the most prominent phenomena of cerebro-spinal meningitis is the tetanoid contraction of muscles, more particularly those of the neck and back. It is therefore important to learn, if possible, how such contractions are produced.

Strychnia is a substance which, if taken into the blood, is capable of causing tetanoid contractions. It seems to be generally believed that strychnia produces its effects by its action upon the nervous centres of the spinal marrow. Tetanus, also, "is generally admitted to have its essential seat in the spinal marrow."\*

Hydrophobia is another example of tetanoid convulsions now attributed to an affection of the spinal cord. A course of reasoning similar to that which has led to the belief that strychnia produces its effects through the nervous centres of the cord, leads to the opinion that the tetanoid contractions which occur in cerebro-spinal meningitis are due to the action of a blood-poison or of mechanical pressure upon the cerebro-spinal nervous centres. May not the production of all tetanoid contractions be reduced to a general law of method?

In reference to tetanoid symptoms in this disease, Dr. Stillé says: "Their presence unequivocally denotes the existence of spinal lesions."† His view seems to be that they are due to either inflammation or congestion; but tetanoid contractions occur in non-striated muscular tissue through irritation of sympathetic or vaso-motor nerves; and it seems possible that they may occur in other muscles through irritation of cerebro-spinal nervous centres, without inflammation or even congestion.

May not these phenomena of pathology be explained in accordance with recognized phenomena in physiology? Prof. Flint says:

"Taking into consideration the most reliable direct observations upon the sympathetic ganglia and nerves, the fact that their stimulation induces movements in the non-striated muscles to which they are distributed can hardly be doubted. This action is particularly well marked in the muscular coat of the blood-vessels; but here the function of the nerves is so important that it merits special consideration, and will be treated of fully under the head of the vaso-motor nerves. The mechanism of these movements, however, is peculiar. *The action does not immediately follow the stimulation, as it does in the case of the cerebro-spinal nerves and the striated muscles, but is induced gradually, beginning a few seconds after the irritation, endures for a time, and is more or less tetanic.*‡

"This mode of action is peculiar to the sympathetic nerves and the non-striated muscular fibres."§

Now such action may be peculiar to the sympathetic nerves and to non-striated muscles, so far as physiological action is concerned. Voluntary (striated) muscles may not physiologically act in that manner; but in such pathological states as those of tetanus, cramp, cholera, and the opisthotonos of cerebro-spinal meningitis, voluntary muscles do act in such manner. In tetanus the gradually increasing and continuous contraction goes on, in some cases, until the striated muscle is ruptured by its own contractile force, which even then

\* Wood's Therapeutics, Vol. I., p. 823.

† Stillé on Epidemic Meningitis, p. 83.

‡ Italics mine.

§ Legros et Onimus, De la contraction des muscles de la vie vegetative, Journal de l'Anatomie, Paris, 1869, tome VI., p. 428.

§ Austin Flint, Jr., M. D., Physiology, pp. 428-9.

is not abated. In cerebro-spinal meningitis the retraction of the head is sometimes so powerful and continuous that, if the patient be so placed, he will rest only upon the back of the head and the heels. So far as is known to me, there has not been offered any explanation of the physiological or pathological mechanism of such action as this. But if the view of Valentin and Prof. Kolliker as to the non-specific character of the sympathetic nerves be accepted, the explanation does not seem difficult.

"Allowing that the great number of very fine pale fibres in the sympathetic is a prominent anatomical fact, as is also, indeed, the case in the higher nerves of sense and in the gray substance, still, speaking physiologically, I am by no means of opinion that the fineness of the fibres in the sympathetic indicates anything of a special nature in them, and which does not exist elsewhere; but, perhaps, that where this condition does exist, both in them and in other situations, it is connected with a distinct kind of function."\*

In this connection it seems important to bear in mind, that apparently just such action as is caused in non-striated muscles, by stimulation of sympathetic nerves, occurs in striated muscles during tetanoid contractions, and apparently by stimulation of either the nerves as they enter the muscle, the muscular tissue itself, or, what seems most probable, those finer fibres in the substance of the spinal cord which Prof. Kolliker seems to believe to be anatomically the same as sympathetic nerves, and "connected with a distinct kind of function."

If it be admitted that direct stimulation, or irritation of nervous centres of the spinal cord may cause tetanoid contractions of striated, so-called voluntary muscles, the conception may be of very great importance in the study of the nature of the causes not only of cerebro-spinal meningitis, but of all that class of diseases which manifest tetanoid symptoms; such as tetanus itself, hydrophobia, cholera, etc. The phenomena attendant upon poisoning by strychnia seem to be capable of explanation in accordance with this view. This substance is absorbed into the blood, and circulates through the tissues. It causes simultaneous tetanoid contractions of different striated muscles supplied with spinal nerves, and when it is excreted from the body, such contractions cease. As stated by most authors, the contractions are probably due to the influence of the drug upon the spinal centres. Dr. Brown-Séquard has expressed the opinion that strychnia has the power of stimulating the nervous centres of the spinal cord "independently of the quantity of blood which it contains."† According to Stillé, it also augments the tone of the muscular coat of the bowels and bladder. "In like manner it is reported to excite uterine contractions."‡ It appears, therefore, to act upon the non-striated as well as the striated muscular tissue. If the direct irritation of the spinal centres, by substances in the blood, can cause action of striated muscles supplied with nerves from that source, similar to that caused in non-striated muscles by irritation of the sympathetic nerves of the part, then the fact is entirely in harmony with the view of Kolliker, that the nerves in the two situations are anatomically the same, and we would expect that substances capable of acting upon non-striated muscles through the sympathetic nerves, if applied as a blood poison would be, directly to the cerebro-spinal centres, would produce

\* Kolliker's "Microscopical Anatomy," p. 428.

† Stillé Therap. & Materia Medica, Vol. II., p. 151.

‡ Stillé Therap. & Materia Medica, Vol. II., p. 152.

somewhat similar effects in the striated muscles supplied with nerves from the cerebro-spinal centres.

But, of the *post-mortem* appearances in poisoning by strychnia, "congestion of the membranes of the brain and spinal marrow is probably the most common,"\* and the tetanic contractions may be largely due to mechanical pressure and irritation of the nervous tissue.

It seems proper to look for the cause of the tetanoid contractions in cerebro-spinal meningitis among those agents which have been known to produce such results. There is no evidence that it is due to strychnia. There is evidence that leads to the belief that cold is a factor, but it also seems probable that it is only a factor, and that there is some other cause, and perhaps a more important one. Next to the two just mentioned, one of the most powerful causes of contraction in non-striated muscular tissue is ergot. If given in sufficient quantity, and continued sufficiently long, may not ergot stimulate to contraction voluntary as well as involuntary muscles? May it not act upon the cerebro-spinal nervous centres in the same way that it is known to act upon the sympathetic and vaso-motor nerves?† For our present purposes an affirmative answer to this question is not essential, for congestion of the spinal cord is usually found in all of these diseases in which tetanoid contractions occur, and this, in my opinion, may be caused by the direct action of ergot, as will perhaps appear in another part of this paper. That ergot does cause contraction of the non-striated muscular tissue there can be no doubt. Dr. H. O. Hitchcock, President of this Board, says: "I venture this proposition, viz.: 'the physiological action of ergot is upon the unstriated muscular fibre wherever found, to produce tonic and contraction therein.'"‡

Dr. Stillé says: "We have elsewhere (Vol. I., p. 782) directed attention to the grounds upon which Dr. Brown-Séquard explains the curative power of ergot in certain cases of spinal paralysis. This eminent physiologist has shown that by its power of causing contraction in the unstriated muscular fibres of the arteries it limits the afflux of blood to the parts upon which the medicine specifically acts, and in the present case diminishes the amount of blood in the spinal cord and its membranes."§ This last statement may require modification, because of the thinness of the muscular walls of the blood-vessels in that part.

Dr. Hammond says:

"The action of the ergot is to lessen the diameter of the blood-vessels of the cord by its constricting power over the organic muscular fibre entering into the composition of their walls. Ten years ago I spoke as follows: 'But I have recently ascertained by actual experiment that ergot does exert the influence in question. I prepared a weak aqueous infusion of this substance, and placed it on the web of a frog's foot, under the microscope. In a few moments contraction of the capillaries ensued, and they became so small as not to allow of the passage of the blood-corpuscles. This experiment I have repeated several times, and I am perfectly satisfied that the result is as I have stated. More, I have frequently injected small quantities of the infusion into the stomach of frogs, and contraction of the capillaries of the web always followed.'"§

\* Taylor's Prin. & Practice of Medical Jurisprudence, Vol. I., p. 406.

† See page 621, Vol. II., Stillé Therap. & Mat. Medica.

‡ Peninsular Med. Journal, Oct., 1874, p. 485.

§ Stillé's Therapeutics and Materia Medica, Vol. II., p. 628.

§ Diseases of the Nervous System, by Wm. A. Hammond, M. D., pp. 892-8.

Here we have direct proof of the action of ergot upon the non-striated tissue of the blood-vessels.

"In its operation upon the pregnant uterus, it produces a constant, unremitting contraction and rigidity, rather than that alternation of spasmodic effort and relaxation which is observable in the natural process of labor."\*

In this city, a few years since, expulsion of an immature fœtus was caused by the use of ergot alone, there being good reason to believe that no other cause contributed to the result.

"Dr. Henschel reports a case in the *New York Medical Record* for September 1, 1874, where thirty minims of Squibb's fluid extract of ergot were given by mistake to an infant. Soon afterward there were severe abdominal pains, recurring every fifteen minutes, and lasting hardly sixty seconds. There were slight tetanic contractions of muscles of face and extremities. Diarrhœa set in four hours after administration, and continued fourteen days."†

There is also other evidence that the action of ergot is not confined to non-striated muscular tissue, but is capable of causing convulsions of the entire body. From *Cyclopedia of Practical Medicine*, 1845, Vol. IV., p. 456, I quote as follows: "When the ergot is exhibited to man in a dose of about two drachms, the symptoms usually produced by it are vertigo, headache, suffusion of face, nausea, succeeded by vomiting and purging, spasms of the stomach and intestines, and an universal feeling of debility and fatigue. If gradually introduced into the system, as occurs to those who have used for a considerable time rye meal impregnated with it, the effects are materially different, and of a two-fold description. Either a convulsive disorder is established or the disease usually known under the name of dry gangrene. The former begins with dimness of sight, giddiness, and insensibility, *symptoms which are quickly succeeded by frightful convulsions of the entire body.*‡ In this severe form the disease proves rapidly fatal; but in milder cases the convulsions occur only in paroxysms,|| and in the intervals the chief indication of disease which presents itself is an extreme voracity of appetite. This voracity either terminates in death, preceded by coma and convulsions, or in recovery after the previous appearance of anasarca, diarrhœa, *cutaneous eruptions*,‡ or abscesses in different parts of the body."

#### A CASE OF TETANUS FOLLOWING THE USE OF ERGOT.

In the *Am. Med. Times*, May 9, 1863, a case of puerperal tetanus is reported. Just after an attack of mumps the patient had a miscarriage, being three months pregnant. She had hemorrhage, for which 10 drops of fluid ext. of ergot were given every four hours. The hemorrhage ceased, but after three days, during which it seems the ergot was continued, she felt stiffness of the jaws, followed by difficulty of swallowing, and the head was occasionally drawn back in tonic spasm. She died about three days after the attack.

#### FATAL POISONING BY ERGOTIZED GRAIN.

"A case of acute poisoning from ergot is recorded by Dr. Pratschke, in which uneasiness in the head, oppression of stomach, diarrhœa, urgent thirst,

\* U. S. Dispensatory, p. 870.

† The Cincinnati Lancet and Observer, Nov., 1874, p. 704.

‡ Italics mine.

|| May not the distinction usually made between clonic and tonic spasms be only one of difference of degree; the clonic spasm resulting from an excitation less than that which causes tonic or tetanoid muscular contraction?



burning pains in the feet, tetanic spasms, violent convulsions, and death ensued from eating freely of ergotized grain (*Lond. Med. Gaz.*, Oct., 1850, p. 579)\*.

The following instance of ergot poisoning is taken from *The American Journal of Medical Sciences* of 1868, Vol. LVI., p. 577:

*Poisoning from Eating Bread Containing Ergot.*—"Dr. Flinzer (Von Horn's *Vjschr. f. Gess.* VIII., 1868) states that the entire family of a farmer, consisting, with his laborers, of over ten persons in all, after partaking of bread containing a large portion, say one-tenth, of ergoted rye, sickened. The symptoms were at first debility, giddiness, and loss of appetite; subsequently were added a feeling of distress, a creeping sensation in the hands and feet, tonic contractions of the extremities, profuse sweating, great thirst, and diarrhœa. A pregnant female was brought to bed five weeks before her proper time. Two of the patients died, but the fact became known too late to allow of an autopsy being made."

Speaking of ergotism, Prof. Gross says: "In this country I am not aware that it has ever been noticed in the human subject. It is said, however, to have prevailed extensively among the horned cattle of Chester county, in this State, in 1819, and in the following year in Orange county, New York, in consequence, as was supposed, of the free use of the green grass, the *poa viridis*, the seeds of which were affected with ergot."†

From "The Half-Yearly Abstract of the Medical Sciences" of 1869-70, Vol. LI., p. 100 we extract the following:

#### CASE OF POISONING BY ERGOT.

(By G. S. Oldbright, M. D., in *Canadian Medical Journal*, March.<sup>1</sup>)

"In the case related by Dr. Oldbright, the ergot was given three days after delivery, to control secondary hemorrhage. The loss of flooding was very slight. About two hours or more after the administration of the ergot the patient began to feel a tingling in the fingers and feet, cramps in the legs, arms, and chest, dizziness, and weakness. The pupils became dilated, and the pulse very small, and, if memory serves, accelerated; at the same time a feeling of coldness was complained of. Stimulants and warmth were applied. In about an hour the symptoms gradually subsided, and all went on well for a few hours, when the same symptoms recurred, but with greater intensity. Stimulants were again administered. Heat was applied to the surface of the body by means of extra bed-clothes, hot bottles, and flannels dipped in hot water. This was continued for two or three hours, and it was not till the end of that time that the slightest diaphoresis, or even a good glow of heat was induced. Then the face and head suddenly became intensely congested, being of a purplish-red color. Pain was felt in the head, and the patient seemed much excited and confused. A brother practitioner was called in, and it being feared that convulsions would occur, cold cloths were applied to the head. This intense engorgement gradually subsided, but the congestion continued for two or three days, as manifested by pain in the head, photobia, etc. Another symptom which was noticed was a diarrhœa, in which the stools were of a dark gray color, looked as though meal had been stirred through them, and had a peculiarly sickly, indescribable odor. They were accompanied by

\* U. S. Dispensatory, p. 870.

† Gross' System of Surgery, Vol. I., p. 209.

<sup>1</sup> Abstract of a paper read before the Medical Section of the Canadian Institute, Toronto, Feb. 4, 1870.

gripping pains. This condition of the bowels was noticed in another case, occurring a few months after, where ergot had been given. Here, also, there had been a good deal of weakness, and a continual recurrence of faintness, but this was attributed to loss of blood during labor and before it, the case having been almost one of placenta prævia."

"After alluding to two other cases, not so well marked as that given above, however, of which he had been informed by other medical men, Dr. Oldbright dwelt briefly upon the *modus operandi* of ergot in these cases. Wood, in his *Materia Medica and Dispensatory*, teaches that it is a direct depressant, partially paralyzing the heart and the capillaries. Dr. Oldbright did not feel prepared to go very deeply into the question, but it seemed to him probable that its primary action is excitant to the special and sympathetic portions of the nervous system, exciting muscular contraction and increased tonicity of musculo-fibrous and fibrous tissues. Hence the spasms which it causes. In this way it could diminish the calibre of the arteries and capillaries, whilst it would impede (and here we must remember how continuous and unremitting is its action on the womb), the action of the heart, keeping it in a condition of continuous partial contraction. This causes starvation of the brain (as well as of the other parts), and at once brings on the second stage,—faintness, vertigo, etc., etc. This is soon followed by the third stage of reaction and congestion of the brain."

"Amongst a number of arguments the following were adduced: It is inconsistent to attribute to the same drug the power of directly exciting muscular action in one organ, and of directly paralyzing others. Dr. Wood himself confesses, when speaking of the recommendation ergot has received in paraplegia and paralytic conditions of the bladder, that its 'applicability in these cases would scarcely be inferred from anything that is known (according to his theory) of its physiological effects.' This points to a power of inducing muscular action: so, also, do the cramps in the legs, chest, etc., which he does not explain. Again, paralysis of the capillaries would not, as Dr. Wood asserts, arrest hemorrhage. He takes it for granted that the capillaries have, *in se*, the power of propelling the blood."

#### ANIMALS SOMETIMES HAVE CEREBRO-SPINAL MENINGITIS.

During the epidemic at Petersburg I did not learn of any case of the disease affecting the lower animals, but in other localities it has done so. Dr. Upham of Massachusetts says: "Returns from Boston, Brighton, Charlestown, Fall River, Lynn, Newton, Stockbridge, Wakefield, and Worcester, all speak of the existence of the disease, to a greater or less extent, among animals. Horses and cows appear to have been most often affected; after that hens and chickens, and in some instances dogs and cats." \* \* \* "Dr. O. H. Flagg, a well-informed and reliable veterinary surgeon of New Bedford, writes as follows: 'Since the first of January sixteen cases of the so-called cerebro-spinal meningitis have come under my observation and treatment. Of these, fifteen were horses, and one a calf four months old.' \* Dr. Flagg gives the symptoms and *post-mortem* appearances, which are similar to those in the human body.

"Dr. Robert Law of Dublin, in reporting several sporadic cases of cerebro-spinal meningitis, observed by him in 1865, writes: 'It is a fact worthy of recording, that at the time we were attending this lady [suffering from cerebro-

\* Report State Board of Health, Mass., 1874, p. 306.

spinal meningitis] nine rabbits out of eleven, which her son had, died all in the same way; their limbs seemed to fail them, they fell on their side, and then worked in convulsions, and died. Two hens fell lifeless from their roost.' Three of the rabbits were examined; in two there was congestion of the vessels of the base of the brain, and in the other vascularity of the membranes of the spinal marrow (*Dub. Jour. of Med. Sci., May, 1866*)."\*

"It is a noteworthy fact, that during the past eighteen months a very fatal purpuric disease has been rife among pigs in Dublin. Dr. Mapother thinks that there is much resemblance between this epizootic and human purple fever. Mr. Hugh Ferguson, the veterinary officer of the Privy Council for Ireland, states that 'purples' among pigs was very prevalent during 1846, when cerebro-spinal meningitis was epidemic at Dublin and Belfast."†

#### ACTION OF ERGOT ON ANIMALS.

"Several experimenters have called attention to the remarkable aversion shown by *dogs* to food containing ergot. Tessier says they would rather die of hunger than eat it. Gross found it impossible to make them retain any of it except by fastening the mouth, and even then a portion of it would be vomited through the nostrils. Wright, in his numerous experiments, introduced the medicine into the stomach through a gum-elastic tube. Diez noted as its principal effects profuse salivation, vomiting, dilatation of the pupils, hurried breathing, frequent pulse, cries, trembling, staggering, paraplegia, sometimes diarrhoea, sometimes constipation, prostration, urgent thirst, convulsions, and death. Similar symptoms were observed by Wright. (*Ed. Med. and Surg. Jour., LIII., 319.*) This experimenter injected a strong infusion of ergot into the jugular veins of dogs. The symptoms were dilated pupils, a rapid pulse, convulsions, and flaccidity of the limbs followed by their tetanic rigidity, which continued after death. When a weaker infusion was employed, it caused great temporary excitement, followed by depression. A still more diluted preparation seemed to exhaust life by a progressive seductive operation. Similar results ensued when the solution was thrown into the peritoneal cavity. The more gradual action of ergot upon dogs was shown by Wright. He mixed from one to two ounces a day with the animal's food, and produced its death in the course of six or seven weeks. The succession of symptoms may be thus described. An immediate but temporary effect was shown by weakness of the hinder legs and dullness of vision, but day after day the animals grew duller, suffered from thirst, loss of appetite, and dryness of the nostrils. Then paralysis and anæsthesia of the hinder legs became more evident, the flesh wasted, acrid tears destroyed the hairs upon the face, sight and hearing failed, the heart was slow and feeble, the breath fetid, the stools and urine passed involuntarily, and death took place by exhaustion. The muscles were found, on dissection, to be pale and flabby, the heart was full of dark blood, the bronchial lining membrane and trachea were bathed in pus, the mucous membrane of the small intestine was injected. Tubercles were found in the lungs in some cases, and in some there were purulent collections in the joints."

"In Tessier's experiments, ergot was mixed with the food of *pigs*. (*Revue Med., XLIII., 140.*) They showed a reluctance to eat it. Its first effects were redness of the eyes and ears; the latter organs and the limbs then grew cold,

\* Quoted from Aitkin's *Sci. and Prac. of Med.*, Vol. II, p. 456.

† Quoted from the *Half-Yearly Abstract of the Med. Sciences*, July to Dec., 1867, page 15, being an abstract of a paper read before Epidemiological Soc. of Dublin, by E. D. Mapother, M. D.

the joints swelled, gangrene attacked the ears, limbs, and tail, and the animals died in convulsions. One of them, six months old, lived for sixty-six days. Its intestines are described as having been inflamed and gangrenous."

"Parola (*Annales de Thérap.*, ii, 89) gave from half an ounce to two ounces daily to a *mule*. From the second day the pulse fell, the heart grew feeble, irregular, and jerking, the breathing low and deep; the appetite and flesh failed; tremulousness, a staggering gait, and dullness succeeded, \* \*."

"The action of ergot upon *birds* is much more distinct and decided. Bonjean (*Traité Théorique et pratique de l'Ergot de Seigle*, Paris, 1845) gave two drachms daily of powdered ergot to *cocks* and *hens*. About the seventh day they became dull, languid, without appetite, and were affected with diarrhœa. In some cases the comb grew cold, blue, flaccid, and covered with ecchymoses; in others it was ulcerated. Black blood flowed from the nostrils, the animals were unable to walk, their breathing grew slower, and emaciation and death followed. In other cases the plumage was shed, and the beak and claws were surrounded by a bluish circle. The experiments of Tessier on *ducks* (*Revue Méd.*, XLIII., 138) furnished results almost identical with these; and in a turkey the symptoms were precisely like those just described. Gross, of Breslau (*Cantatt's Jahresbericht*, 1845, p. 255) gave ergot, or else bread that contained either it or ergotin, to *pigeons*. At first they were disposed to vomit, but in the course of two or three days showed an increased appetite. This, however, was followed by dullness, restlessness, or immobility, convulsive twitches of the muscles, diminished action of the heart and lungs, and *death between the fourth and seventh day*.\*

Similar effects were produced in fowls and small birds, such as *linnets* and *sparrows*, the former of which died within forty-eight hours after eating fifteen or twenty spurs of ergot."

"Bonjean gave three drachms of the *oil* of ergot to a rabbit; it appeared distressed and feeble, and *was afterwards convulsed with opisthotonos*."\*

To birds it generally proved fatal, but first produced symptoms of narcotism. Six drachm doses were not fatal to dogs, but occasioned in one case spasmodic symptoms, and in another only nausea and drowsiness. The earlier experiments of Wright with oil of ergot gave similar results to these."

"The lesions produced in animals by chronic ergotic poisoning may be thus summarily described. The venous system is engorged.† In poultry, the general color of the comb and wattles is purplish, with small blackish points, and the edges of these appendages are always quite black, and sometimes also hard and brittle. The gastro-intestinal mucous membrane is usually injected, particularly at its upper portion,† sometimes softened, and occasionally ulcerated and gangrenous. In birds, the gizzard is soft and vascular; the liver is generally enlarged and its consistence is sometimes diminished; *the meningeal vessels are usually injected, and the brain and spinal marrow, in a small proportion of cases, softened*;\*† the lungs are congested, and the blood is liquid and black;† in nearly every case the muscles are rigid for some time after death; in some instances this condition is permanent, especially in the hinder legs of quadrupeds."

"The influence of ergot upon the gravid uterus in animals is not uniform. In some cases it seems to have been purely negative, in others to have destroyed the

\* Italics mine.

† Compare with cerebro-spinal meningitis.

product of conception without producing its expulsion, and in still others, and these are the most numerous, to have caused abortion. Bonjean gave ergot to a female *guinea-pig* during the early stages of gestation; abortion was not occasioned, nor, indeed any symptoms whatever; so that the result of the experiment was purely negative. (*Op. cit.*, p. 78).” It may be that the lack of uniformity of action upon the uterus was due to the fact that the oil of ergot extracted with ether does not act in that manner, while that part which is left after the oil has been thus abstracted, does act upon the human uterus.\* The two observers, Bonjean and Wright, who failed to get any action upon the uterus of animals, were the same who were mentioned as having experimented with the oil of ergot. “The experiments of Wright were to this effect; he mixed ergot with the food of a pregnant rabbit; no tendency to abortion was excited, and in due time six healthy young ones were born. The animal, still kept upon the same food, was again impregnated; she looked drowsy and moped, the fur grew erect and rough, gestation was *protracted* beyond its usual term, and three young ones were born, two of which were dead, and the third one survived but a few hours. Subsequently an abscess formed under the lower jaw, the front teeth dropped out, pus flowed from the eyes, diuresis and diarrhœa succeeded. In the twelfth week the animal died. The lungs and mesentary were tuberculous, but the intestines were sound. The same experimenter, after many trials of ergot upon pregnant bitches, concluded that it did not act as a parturificient in them, although it sometimes appeared to injure or destroy the product of conception.”

“On the other hand, according to Diez, it produced abortion in *bitches* and in *guinea-pigs* without harm to the mother or the young, when the dose was moderate; but large doses destroyed both, and excited inflammation of the womb. In 1825, Dr. Oslere gave ergot to a *sow*, a *cow*, and a *cat*, before the completion of pregnancy, and in each case produced abortion (*Phila. Jour. of Med. and Phys. Sci.*, XI. 106). In 1841 an epidemic of abortion among cows occurred in the neighborhood of Trois Croix, in France, which was traced to the ergotted state of the rye and other gramineæ in that district. (*Edinb. Month. Jour.*, Jan., 1842, p. 73). According to Percey and Laurent, a decoction of ergot injected into the veins of a *cow* caused the animal to calve speedily.”

“The following statement of Youatt shows conclusively that ergot acts upon the uterus of animals in labor precisely as it does in the case of the human female. ‘I have for the last six or seven years been in the habit of administering the ergot of rye to quadrupeds, in cases of difficult or protracted parturition. . . . In the *monogastric*, if I may venture to use the term, I have never known it to fail of producing considerable effect, even when the uterus has been previously exhausted by continued and violent efforts. In the *ruminant*, with its compound stomach or stomachs, I have witnessed many a case of its successful exhibition. . . . The uterus has in every case responded; it has been roused to a greater or less degree of renewed action. (Pereira, *Mat. Med.*, 3d Am. Ed., ii., 137).”†

#### ACTION OF ERGOT ON MAN.

“*On Man*.—In 1824 Lorinser and several companions took each of them two drachms of powdered ergot upon bread and butter. The symptoms in all the

\* See last paragraph on page 621, Vol. II., Stille's Therap. & Mat. Medica.

† The foregoing quoted from Stille Therap. & Mat. Med., Vol. II., pp. 610-613.

cases were alike, and consisted of some colic, nausea, and vomiting, salivation, occasionally diarrhoea, and a sense of fulness in the head. (*Edinb. Med. and Surg. Journ.*, XXVI., 453.) Similar effects were obtained by Gross and an associate who each took a drachm of ergot. (Canstatt's *Jahresbericht*, 1845, p. 256.) And such also are the symptoms ascribed to the medicine by Raige-Délorme (*Dict. de Med.*, 2eme ed., XVIII., 271). Trousseau and Maisonneuve, besides the above effects, particularly noticed dilatation of the pupils as the most constant phenomenon. It began within twelve or fourteen hours, and continued for several days. The sight was not affected. Headache and vertigo, sometimes so marked as to resemble intoxication, and followed by drowsiness, were also observed. (*Bull. de Therap.*, IV., 106.) Hussa describes similar symptoms as produced by bread containing a sixth or a fifth part of ergot. The headache generally continued for several days. (*Ibid.*, LIII., 285.) Bonjean took a drachm of powdered ergot in three equal doses before breakfast, and found that the symptoms were precisely such as have been described. Other testimony to the same purpose might be adduced, but it is scarcely necessary, since the results here cited were so uniform." \* \* \* \* \*

"The power of ergot to lower the *pulse* is unquestionable. In some experiments upon himself, Parola found that his pulse fell from 74 to 60, and from 79 to 72 (*Annales de Therap.*, II., 91), and Dr. Quinton Gibbon of New Jersey observed a decline of the pulse in himself from 70 to 57, and in another person from 64 to 55. In this case a repetition of the trial produced the same result. Arnal's numerous experiments showed that the action of a drachm of ergot commenced within an hour, and in the course of four hours lowered the pulse from 84 to 62. After allowing for the influence of natural causes, the time of day, rest, etc., it appeared that the pulse was still lowered, on an average, eight beats in a minute. In febrile affections, the influence of the medicine was still more marked, and sometimes the pulse fell 30 and even 36 beats in the course of five hours. The experiment upon the healthy system was four times repeated at intervals of ten days, and uniformly with the same result. (*Bull. de Therap.*, XXXVI., 534.) Bonjean found that a drachm of ergot lowered his pulse from 70 to 60. In parturient females Dr. Hardy observed that within 15 or at most 30 minutes the medicine produced a marked diminution of the pulse, which sometimes continued for several days. (*Dublin Journ. of Med. Sci.*, XXVII., 225.) Beatty estimated its reduction, under like circumstances, at 20 beats in a minute. According to Bonjean *ergotin* reduces the force but not the frequency of the pulse; but Guiland and Arnal state that it does both."

"The earliest experiments to illustrate the power of *oil* of ergot were performed by Dr. Charles Hooker of New Haven, in 1831-2. He obtained the oil by macerating ergot for several days in ether, decanting the liquid and evaporating the ether. To a medical student he gave half a drachm at two o'clock P. M., a drachm at three o'clock, and the same quantity at four o'clock. Under the second dose the pulse fell from 82 to 65, and under the third dose to 36; and the respiration from 19 to 8. Of the general symptoms, the first was a sense of tightness, followed by an unpleasant, heavy, and confused feeling in the head, and nausea like sea-sickness, general languor and lassitude, constant spitting, and vivid flashes of light before the eyes. Under the second dose there was, in addition, painful rigidity of the muscles, lassitude, lividity of the skin, dilated pupils, and a heavy countenance.\* Under the

\* Compare with Cerebro-Spinal Meningitis.

third dose there was, besides an increase of these symptoms, diuresis. The same phenomena were manifested in another experimenter, and in neither case did they entirely disappear for nearly a week afterwards. For three days the pulse continued under 50, the skin was still dusky, and the muscles sore. When the same oil was given in labor, no influence whatever on the uterus was displayed, but upon the child a very marked impression, as will presently be seen. Dr. Hooker then used the ergot, from which the oil employed in the above experiment had been abstracted, and found that its ecbotic powers were entirely unimpaired. [*Bost. Med. and Surg. Journal* (1834), X., 298.]”

“If the phenomena here described are compared with those produced upon man by ergot in large doses, it is evident that they are identical, and that the toxic effects of this substance are due entirely to the oil which it contains.”

“Schroff, in his experiments, observed that pure ergotin in doses of from one-third of a grain to one grain produced fullness of the head, headache, and dilatation of the pupils, followed by colic and infrequency of the pulse. (*Reil's Mat. Med., d. rein. chem., Pflanzenstoffe*, p. 166.)”

“Among the effects of ergot may be noticed those which are occasioned by the use of food containing a large proportion of this substance, and which are included under the general name of *ergotism*. The records of this disease have been traced back to classical times, but they are more clearly to be recognized in the descriptions of epidemics of dry gangrene, one of which was recorded by Sigebert de Gremblour in 1096 (*Goupil, Journ. des Progres*, III., 161.) In 1597, a spasmodic disease which was attributed to ergoted rye, prevailed in Hesse and the adjacent territories. Epidemics of the same sort occurred in 1648, 1675, 1702, and 1716, in Germany, as well as in Flanders, and in France. In Sologne, a French province where rye is much cultivated, this disease has repeatedly been prevalent. Two forms of the affection have been described, the spasmodic and the gangrenous. (Ozanam, *Maladies Epidem.*, IV., 226; Bergen and Muller, *Haller's Disputations*, I., 78; Duvivier de Saint Hubert, *Traite Philosophique des Maladies Epidemiques*, etc., Paris, 1836; Heusinger, *Studien uber den Ergotismus*, *Abstract in Journ. f. Pharmakodyn*, I., 404.)”

“*Spasmodic ergotism* begins with malaise, formication of the whole skin, cramps, and numbness of the extremities, and pains in the head and back. This state lasts from one to three weeks, and ushers in heartburn, epigastric oppression, vertigo, syncope, deafness, paroxysmal or permanent flexure of the joints, or equally violent extension and opisthotonos, twitching of the facial muscles, in some cases violent delirium, with cold skin, intense internal heat, and fetid sweats. The attacks are sometimes preceded by digestive disturbance, and last from half an hour to two hours or more. After a time the convulsions cease. They are followed by exhaustion, debility, oppression, heartburn, and a ravenous appetite, which it is dangerous to gratify. Sometimes strabismus or loss of sight succeeds (Meier of Kronstadt has shown that cataract is a very usual consequence of chronic ergotism,—see *Archives Gen. de Med.*, Mars., 1863, p. 350), with an eruption of bullæ upon the skin, or general insensibility. After death in fatal cases, the stomach and bowels are found inflamed, and the parenchymatous organs congested. The attack usually lasts for three or four weeks, and is very fatal. In 1735, during an epidemic in Wurtemberg, out of 500 persons attacked, 300 under 15 years of age perished.”

“The *gangrenous* form of ergotism is quite different from the foregoing.

The first symptom is a dull pain and weariness of the limbs, with a heavy and stupid expression of countenance. The skin has an earthy or jaundiced hue. The extremity or the nose about to become affected grows quite cold, and the skin over it is of a dusky red color. The gangrenous process generally begins in the central parts of the limb, and afterwards attacks the skin, extending upwards towards the trunk from the fingers and toes, causing these parts to blacken, shrivel, and harden, until they resemble the flesh of a mummy. Sometimes, however, they present the appearance of ordinary gangrene. In either case the finger, the toe, the nose, or even the extremity, separates itself from the body without hemorrhage, leaving a clean wound behind. Sometimes the flesh only is thrown off, and the bone has to be divided artificially. Cases are reported in which all four of the extremities were thus lost. Meanwhile the digestion is not always deranged, although death is sometimes preceded by diarrhoea. The attack is seldom shorter than three weeks, and in the vast majority of cases is fatal.\*

## TWO FORMS OF ERGOTISM.

It may be well to suggest an explanation of the manner in which ergot may act to produce sometimes spasmodic symptoms and at other times gangrene. It seems to have been proved that the oil extracted from ergot by ether, although it has active properties, does not cause well marked contraction of non-striated muscular tissue, and that what remains of ergot after the oil has been thus abstracted is capable of such action.†

The active properties of the oil may exist in a volatile acid (ergotic) and a volatile alkaloid (propylamia) extracted with the oil, as the oil itself has been stated to be a fixed oil, and "when procured by expression, this has been found to be inactive." \* \* "Mr. Wenzell claims to have discovered in it [ergot] two new fixed alkaloids which he proposes to name respectively ecbolina and ergotina, and in which, along with the volatile alkaloid propylamia, the virtues of the medicine reside."‡

Just which "virtues of the medicine" reside in the fixed alkaloids he does not state, but that it is the action upon non-striated muscular tissue, is in accordance with the facts stated above, that the ergot after the oil had been abstracted was still capable of causing contraction of non-striated muscles and the poisonous properties of the oil were due to a volatile acid and alkaloid extracted with the oil. "Mr. Wright also states that the oil of ergot lowers the pulse and renders it less frequent. It may also be mentioned here that he found the vapor of this preparation [etherial extract of ergot] diffused through the air of a close room produced a tingling sensation in the limbs, distressing lassitude, irritability, and giddiness. (*Edinb. Med. & Surg. Journ.*, July, 1840, p. 51.)"§

If it be true that certain of the poisonous properties of ergot exist in great part in the volatile principles, and that to the fixed alkaloids is due the contractions of the uterus and non-striated muscles generally, it may be that we have in these facts an explanation of the two kinds of ergotism which have been observed, viz., the spasmodic and the gangrenous; and that the first named symptoms result more particularly from the volatile, while the gangrene is due to the action of that part of ergot which is left after the volatile por-

\* The foregoing quotations are from Stille's Therapeutics and Materia Medica, Vol. II., pp. 610-616.

† Stille's Ther., Vol. II., pp. 612, 614, 615, and 621.

‡ U. S. Dispensatory, 12th Edition, p. 363.

§ Stille's Therap., Vol. II., p. 615.



tion has been driven off, as, for instance, it might be during the baking of bread.

More exact observation and analysis of facts are needed, however, before a conclusion can be reached on this point, and the suggestion is offered with a view of stimulating observation and experiment in this direction.

Dr. Gross says:

"The manner in which ergot acts in producing this disastrous effect has not been explained. It is very singular that its virulence should explode upon those parts of the body which are most remote from the heart, as the feet and legs, and the corresponding portions of the upper extremities, along with the nose, chin, and ears. I am myself inclined to believe that the primary impression of the poison is upon the blood, rendering it abnormally stimulant, and plastic, and the secondary upon the inner coats of the arteries, which, becoming inflamed, thereby intercepts the liquid, and thus leads to the formation of fibrinous clots. In a word, there is reason to believe that mechanical obstruction of the vessels is the direct and immediate cause of gangrene." \*

In speaking of ergot and its action upon the uterus, a writer in Appleton's Cyclopaedia says: "Its action has been shown to extend to other organs possessing smooth muscular fibres." \* \* "It is probably by this action upon the blood-vessels that the epidemics of ergotism from the use of diseased grains as food have occurred in different parts of Europe. Ergotism assumes two forms, spasmodic and gangrenous, and probably requires for its production not only the poisonous action of ergot but the additional depressing influences of cold," † etc.

Noticing, first, that this writer refers both kinds of ergotism to the action of ergot upon non-striated muscular fibre, it may be remarked, in passing, that he has reached the same conclusion respecting the influence of cold in causing serious illness from ergotism that has been arrived at as regards cerebro-spinal meningitis, in the causation of which cold is also believed to be a factor.

There is another possible explanation of these two forms of ergotism. If we conclude that the main action of ergot, taken continuously, is that upon non-striated muscular tissue, and suppose persons exposed to this action continuously for a long time without the occurrence of anything to cause a reaction, we must conclude that, whatever other symptoms may present themselves, there will be a lessened calibre of those blood-vessels which have muscular walls, and this may go on to a complete closing of the blood-vessels in certain places, as occurred in the web of the frog's foot experimented upon by Dr. Hammond. ‡

Under such circumstances we would expect atrophy, gangrene, or death of such parts as were most poorly supplied with capillaries, and most remote from the heart; and this without supposing any other action than that known to result from the use of ergot. Continuous use of ergot, without reaction, would seem, then, to be capable of producing the gangrenous form of ergotism. The gangrene is not always of the dry kind, and this may be for the reason that there is congestion and stagnation of blood in the veins, caused by the more forcible contraction of the arteries.

Now, if in addition to the use of ergot there be some such influence as alternations of heat and cold, and through such means there be temporary increase of contraction of capillaries, followed by reaction, equally excessive, it

\* Gross' System of Surgery, Vol. I., p. 208.

† Appleton's Cyclopaedia, Vol. VI., pp. 708-9.

‡ Diseases of the Nervous System, p. 898.

seems possible to conceive of the production in this manner of the "spasmodic ergotism" through disturbance of the capillary circulation in the nervous centres, especially as, though there be capillary congestion from relaxation of striated muscular tissue, the venous congestion may not be removed thereby, because of defective action of the heart, which is known to be influenced by ergot.

This line of thought leads us to consider the question :

#### CAN ERGOT OR A SIMILAR FUNGUS CAUSE CEREBRO-SPINAL MENINGITIS ?

If we understand this question to be : Can an inflammation of the cerebral and spinal meninges be caused by such agents? then I think we must reserve final decision until *post-mortem* examination of a sufficient number of bodies dead from this cause shall disprove or establish the fact; for, although a very great number of epidemics of ergotism have been recorded and described, I know of no satisfactory record of the *post-mortem* appearances of the brain and spinal cords of persons dead from ergotism. The experiments of Dr. H. Day of Stafford, England (previously quoted), did not fully establish this point as regards lower animals, although in one rabbit, that died on the eighth day and in the other two killed on the twelfth day, "more or less congestion of the membranes of the spinal cord was found on dissection." The only abnormal appearance which I observed in the membranes of the brain and spinal cord of a cat which died after eating "smut" from the mill at Petersburg, was an unusual dryness. This has been observed in some cases after death from cerebro-spinal meningitis, and has sometimes been the only abnormal appearance, and it is important to bear in mind that in order to show that the disease in question may be caused by fungi, or by one special fungus, it is not necessary to prove that the fungus always causes death through inflammation of the meninges of the brain and spinal cord, for in many deaths from this disease *post-mortem* examination has demonstrated the absence of such inflammation. But that such inflammation does occur in a certain proportion of cases of cerebro-spinal meningitis cannot be denied, and before anything can be accepted as the cause of this disease, it must be shown that it causes the same *post-mortem* results as well as similar phenomena during life.\*

#### ERGOTISM COMPARED WITH THIS DISEASE.

In another place I have given the effects of ergot in doses insufficient to cause death, and remarked that, with a few modifications, the quotation would answer for an account of the symptoms of mild cases of cerebro-spinal meningitis. In the following account of an epidemic caused by the use of ergotized grain, one cannot fail to notice the very great similarity to the accounts we have of some epidemics of cerebro-spinal meningitis, especially as regards vertigo, disturbance of sight and hearing, formication, anæsthesia, partial gangrene, flexure of forearm or arm, convulsions, clonic and tetanic spasms, smallness of pulse, absence of well-marked fever, normal appetite, uncertain length of the disease, slow recovery, and tendency to relapse.

"In another epidemic, ascribed to the same cause [ergotism], which occurred in Upper Hesse in the year 1855-6, and was described by Dr. Heusinger, the nervous and spasmodic phenomena were predominant, with little tendency to gangrene. Out of 102 persons attacked, 12 died, and these were all under 12 years of age. Not a single individual in good circumstances was affected; but only the miserably poor, who were compelled to live on a damaged crop, in which ergot was proved to exist. The malady generally commenced with ver-

\* For *post-mortem* results in animals, see page 159 of this report.

tigo, and disturbance of sight and hearing, which were followed by formication in the fingers and toes, gradually extending over the body. Spasmodic contractions of the muscles soon appeared; the fingers were firmly flexed, and could be extended only by violence; the forearm was flexed on the arm, and the hands were pressed against the chest; and the toes were also flexed, and the ankles and knees strongly drawn inward. The muscles of the abdomen and chest, including the diaphragm, were also contracted, and the patients breathed with difficulty. The muscles of the face participated in the affection, and even those of the glottis, causing paroxysms of violent dyspnoea. The uterus, whether pregnant or not, was never attacked with spasm. The formication and the tonic spasms were often very painful. The pulse was small, the digestion slow, the appetite normal, and in no instance was there fever. In some cases there was a loss of sensation, generally limited to the fingers and toes, but sometimes occupying large extents of surface, or even the whole body. This anæsthesia always followed the contractions, and was sometimes itself followed by partial gangrene. The loss of sensibility extended sometimes to sight, hearing, smell, and taste. The malady was usually of a paroxysmal character, with intervals more or less prolonged. In the paroxysms there were sometimes tetanic spasms, epileptiform convulsions, loss of consciousness, and delirium of variable duration. The length of the disease was altogether uncertain; generally it continued several months; the recovery was slow; and relapses common. When death took place, it was always in a convulsive paroxysm, and by asphyxia. (Ibid., IX., p. 596, Mai, 1857.) Note to second edition.”\*

“The effects produced by the use of spurred rye as an article of food are very various. In some individuals the influence of the poisonous ingredient is chiefly exerted on the brain and nervous system, the most remarkable symptoms being vertigo, dimness of sight, pain, loss of sensibility, cramps and convulsions, yellow discoloration of the skin, thirst, and feeble pulse. These symptoms are greatly modified in degree in different individuals, and are sometimes slow and at other times very rapid in their progress. In the most acute form of the disease death may take place at the end of one or two days, preceded by dreadful cramps and convulsions of the whole body. Even in the milder cases, the convulsions are more or less severe towards the fatal termination of the disease; and hence this form of the disease is called CONVULSIVE ERGOTISM by French writers, and is vulgarly denominated in Germany *Kriebelkrankheit*, or creeping sickness. In other individuals placed apparently in similar circumstances, the most remarkable effect which follows the operation of the same septic agent is gangrene or sphacelus of certain parts of the body. Hence this form of the disease has received the name of GANGRENOUS ERGOTISM, *necrosis ustilaginea, seu epidemica*.” \* \* \*

“Lang, who observed the gangrenous ergotism in Lucerne, Zurich, and Berne, says that the disease commenced with lassitude and a sensation as of insects creeping under the skin, without fever. Soon after, the extremities became cold, pale, wrinkled, and benumbed, and at last quite insensible and incapable of motion; afterwards acute pain was felt, referable to the central parts of the limbs, which was exasperated by heat and mitigated by cold applications; there was then, also, fever and headache; the pain extended from the hands and feet to the shoulders, legs, and thighs; and lastly, the affected parts became dry, shrunk, and black, and dropped off at the joints. Entire extrem-

\* Wood's Therapeutics and Pharmacology, third edition, Vol. II., p. 722.

ities were thus separated from the body without hemorrhage. Many patients lost both legs, several the arms, and a few both legs and arms. (*Descriptio morborum ex usu clavorum secalinorum cum pane*, 1707.) In other cases, the chief symptoms were, at first, spasmodic contractions of the limbs, afterwards great weakness of mind, voracity, and dyspepsia, which generally terminated in fatuity or sphaelus. (*Rust's Magazine*, XXV., to which the reader is referred for a detailed account of the local and general effect of spurred rye.) The parts most frequently attacked with gangrenous ergotism are the inferior extremities. Men are more subject to the disease than women, and children and old people than adults." \* \* \*

"All these local changes appear to be produced as direct consequences of the spurred rye, acting through the medium of the blood or nervous system, or both at the same time. For we have seen that the dead parts are separated without hemorrhage, and it is stated that the blood, when taken from a vein, is dark and so very thick that it only oozes out from the orifice of the wound." †

"The attention of the profession was first directed to the subject in a prominent manner in 1676, by Mons. Dodard, a French physician, and since then it has been frequently noticed by other writers. For a long time doubts were entertained respecting the power of ergot to produce this effect, and in order to solve these, Mons. Tessier of Paris was commissioned, many years ago, by the Royal Academy of Medicine, to investigate the matter experimentally. For this purpose he selected various animals, especially pigs, ducks, and turkeys, which he fed exclusively upon ergot; he found that most of them died between the tenth and twenty-fourth day, and that distinct marks of mortification existed in all, both externally and internally." ‡

Mr. W. T. Wenzell, of LaCrosse, Wisconsin, has investigated the properties of two alkaloids which he isolated from ergot and named "ecbolina" and "ergotina." § From "ecbolina" in the dose of one-half grain, equivalent to thirty grains of ergot, he experienced the following effects: "The functions of the brain were excited to a species of intoxication, in which participated the muscular system, causing involuntary contractions of the muscles, soon followed by nausea, loss of appetite, a sense of weight and shooting pains through the head, stiffness and soreness of the muscles of the neck and extremities, a creeping sensation along the spine." \* \* \* "The pulse was not materially affected until the stage of debility supervened, when the pulse fell about four beats per minute."

"Mr. W. gave a physician a solution of the chlorate of ecbolina to test its medicinal qualities in uterine hemorrhage and in parturition. \* \* "From the symptoms produced in the doses I had directed him to give, he was compelled to lay it aside, from the energetic and poisonous action it evinced, causing great nausea, with distressing vomiting and intense headache. He thinks the ecbolina to be a powerful agent." §

#### GANGRENE ACCOMPANYING CEREBRO-SPINAL MENINGITIS.

Dr. Henry Wyman of Blissfield, Mich., tells me of an epidemic of cerebro-spinal meningitis which occurred in Madison Co., Ind., in 1848. Out of twelve cases four died. In many cases the arms were flexed, as were the lower

\* Compare with *Cerebro-Spinal Meningitis*.

† *Cyclopedia of Practical Medicine*, 1845, Vol. III., pp. 361, 362.

‡ *Gross' System of Surgery*, Vol. I., pp. 208-9.

§ *Am. Jour. Pharm.*, May, 1864.

§ Quoted from *Am. Jour. Med. Sci.*, July, 1864, pp. 278, 279.

limbs in two cases. There was coma at first, followed by rigidity of the muscles; opisthotonos on the third day; convalescence in about five days. It was a spring following a winter of unusual sickness. During the prevalence of meningitis the usual cases of remittents and intermittents were scarce. There was a case of dry gangrene within three miles of the cases of meningitis. It occurred in February. Two other cases of gangrene occurred in March. He thinks there was black rust on the wheat the previous year.

In the St. Louis Medical and Surgical Journal for May and June, 1865, Dr. T. F. Prewitt, in speaking of cases of this disease, says: "In one, a woman aged about 50, there were large livid-looking bullæ upon the feet." \*

Speaking of the various eruptions attending certain cases of epidemic meningitis, Dr. Alfred Stillé says: "In some cases *gangrene* of the skin has been noticed where the spots have been peculiarly dark, and occasionally, as in typhus, from prolonged pressure." †

In a "Report of five cases of cerebro-spinal meningitis, by Henry Gray Croly, F.R. C.S.I. (Medical Press and Circular, June 5)," a case is mentioned where "black spots became larger, and before death were continuous on his arms, like gangrene." ‡

In speaking of the gangrenous form of ergotism, Prof. Gross says: "The constitutional symptoms vary, being at one time very slight, at another excessive; in general, however, the patient is tormented with fever, thirst, restlessness, and high delirium. *Under favorable circumstances* || ulcerative action is set up, and this, gradually progressing, at length eventuates in spontaneous amputation of the sphacelated structures." §

Concerning an epidemic of "Cerebro-Spinal Typhus," in Ireland, it is said (Med. Times and Gazette, May 25, 1867) that "in some cases of recovery, or in those in which life has been sufficiently prolonged for the maturation of the morbid action, or rather for nature to exhibit the process by which she struggles to eliminate the zymotic poison from the system, the livid ecchymosed spots take on a gangrenous action, thereby producing a degree of constitutional irritation, under which many of the cases succumb." ¶

In the second case of the epidemic of this disease at Petersburg—Charles Boone—the skin over the course of the sciatic nerve of the left leg was discolored, and looked as if about to take on gangrenous action. In this case it could hardly be the result of pressure, as it was not over the points of greatest pressure, but was a band of considerable width, extending down the back of the limb towards the knee joint.

#### DISEASES OF THE EYE IN CEREBRO-SPINAL MENINGITIS, COMPARED WITH SUCH DISEASES CAUSED BY ERGOT.

In this epidemic I was told of a little girl about three years of age, that had "sore eyes, the pupils were dilated; she was blind from some internal cause." She recovered from the disease and also recovered her sight. "Dr. Geo. Fletcher, of Lima, Ind., says that in one case which recovered, the patient lost permanently the use of one eye, there being complete amaurosis." ¶¶

\* Am. Jour. Med. Sci., July, 1865, p. 279.

† Stillé's "Epidemic Meningitis, or Cerebro-Spinal Meningitis," p. 67.

‡ Half-yearly Abs't of the Med. Sci., July to Dec., 1867, pp. 19, 21.

§ Italica mine.

§ Gross' System of Surgery, Vol. I., p. 209.

¶ Dr. E. W. Jenks, in Buffalo Med. and Surg. Jour., Oct., 1868, quoted from Am. Jour. Med. Sci., Jan., 1864, p. 283.

Speaking of the course of cerebro-spinal meningitis, Dr. Meredith Clymer says: "Blindness may happen as an early, almost initial symptom, lasting from a few hours to several days, though Jenks reports a case of permanent loss of sight. Purulent ophthalmia, softening and ulceration of the cornea, choroiditis, hypopion, opacity of the vitreous humor, and posterior synechia may happen, or even rapid destruction of the globe."\*

Stellwag says: "In some cases there is only a severe catarrhal conjunctivitis, which subsequently may be connected with ulceration of the cornea, and thus possibly destroy the eye. In other cases the ophthalmia has from the outset the character of a suppurative iridio-choroiditis, and is developed with severe inflammatory symptoms, intense redness, swelling of the conjunctiva and lids, which also quickly leads to adhesion of the papillary margin to the anterior capsule, and causes large purulent products, which are partly exuded into the anterior chamber as a hypopion, and partly infiltrate the vitreous humor, especially its anterior portion, while the greater impairment, or entire loss of vision, announces the internal participation of the retina, choroid, or optic nerve. The infiltration of the vitreous is betrayed by a very marked bright yellow reflex, which evidently proceeds from a thick opacity lying immediately upon the posterior surface of the lens, and which, from its want of vessels, may be plainly distinguished from a detached portion of retina lying upon the crystalline body. Such suppurative inflammations of the eye have been seen in meningitis in various stages of the disease, the occurrence of which is explained by the extension of the proliferate processes along the sheath of the nerves. Pathological examinations support this view."

"Sometimes an ophthalmia, in the course of a case of epidemic cerebro-spinal meningitis, has the character of a metastatic process."

"Atrophy is the ordinary result of suppurative choroiditis in epidemic cerebro-spinal meningitis, and is often evident at an early period by a marked softness of the globe. As a further consequence, suppurative perforation and phthisis of the globe have been seen."†

Dr. Moreau Morris says: Purulent ophthalmia; softening and ulceration of the cornea; choroiditis and opacity of the vitreous humor, not unfrequently are subsequent symptoms or affections."‡

#### PRODUCTION OF LENTICULAR CATARACT BY THE USE OF ERGOT OF RYE.

*Abstract of a Paper by Dr. Ignaz Meier of Kronstadt.*

"The consequences of the chronic intoxication by ergot of rye produced by the continued use of impure cereals (ergotismus convulsivus and gangrænosus) are, as is well known, nervous diseases of various kinds, contractures, anæsthesia, and alterations of the sensitive organs. The author has observed that ergotism (raphania) is also the cause of cataract. In 1857 the disease prevailed in the southeastern part of Seibenbürgen, Austria, the uncommon wetness of the summer having produced a great frequency of ergotic rye. Two hundred and eighty-three individuals were attacked in six towns, ninety-eight of whom died. The symptoms of chronic intoxication were in the beginning gastric affections, loss of appetite, nausea, diarrhœa, or constipation, and after that a creeping sensation, and a kind of torpor of the limbs; finally cramps. Permanent contractions of the feet the author saw as the conse-

\* Meredith Clymer's Cerebro-Spinal Meningitis, p. 21.

† *Treatise on Diseases of the Eye*, Roosa's and Hackley's translation: New York, 2d ed., 1871. Quoted in "Cerebro-Spinal Meningitis," by Meredith Clymer, M. D.

‡ Report of Board of Health of New York City, 1871, p. 851.

quence of the latter. The pupils were generally dilated, the nails bluish, the skin yellowish or whitish, the temperature of the surface of the body low. The elimination of worms was not observed, nor the occurrence of abortion in pregnant women. The consecutive diseases were, in those more seriously affected, typhus fever, vertigo, amblyopia, or even amaurosis, impairment of hearing, difficulty of speech, insanity or idiocy, epilepsy, periodic fits of laughter, and debility.

"The inhabitants of the district live very poorly, and are much devoted to the abuse of alcohol. The majority of the patients were young. In one hundred and thirty-three cases the age was recorded, and it was found that twenty-five were from 1—10, thirty-one from 11—20, thirty-seven from 20—30, sixteen from 31—40, eleven from 41—50, nine from 51—60, four from 61—70 years. Death mostly occurred in younger individuals.\*

"In the year following the epidemic the author was called on by a comparatively large number of individuals with cataracts, and came to the conclusion, after careful inquiry, that cataract was frequently consecutive to ergotism. Of twenty-three persons affected, fifteen were females and eight males; three were from 10—20, seventeen from 20—30, and three from 50—60 years. The raphania had lasted in these cases from six weeks to three months. The prevailing symptom had been cramps. In fifteen cases, a headache, lasting for months, or even a year, and combined in some cases with vertigo and noises in the head, had followed the disease, and after it had subsided, or sometimes during its existence, the gradual loss of sight in one, and soon in the second eye, had taken place. The production of cataracts was always slow, and in all cases bilateral. The consistency of the diseased lens was found to be hard two, soft twelve, and semi-fluid nine times. Complications were not present; the optic nerve and retina seemed unaffected, and the operation had mostly a good result.

"The author believes to have a right to assume that the cataracts were produced in consequence of the disturbances of nutrition of the crystalline body, caused by the chronic intoxication, or rather on the thereon dependent changes in the nervous and vascular system.

"The symptoms produced by ergotine and the oil contained in the ergot of rye are, according to Professor Schroff (*Pharmacology*, Vienna, 1856, p. 548), nausea, dryness of the throat, loss of appetite, fullness, pain and stupor in the head, dilatation of the pupils, gastralgia, and enteralgia, and diminution in frequency of the pulse. It is rendered probable, the author states, in conclusion, by observations of a less recent date, that ergotine has a peculiar influence on the system of the ciliary nerves, and influences that way the nutrition of the lens, while on the other hand, the convulsive contractions of the eye-muscles, as they were frequently observed by the patients, may have caused a change in the nutrition of the lens, like the cataracts occurring after convulsions in young children. [?]*—Am. Journal of Ophthalmology.*" †

#### SOURCES OF FLOUR IN CITIES AND IN RURAL DISTRICTS.

Excepting outbreaks of the disease in garrisons and at workhouses, etc., I think it will be found that a small proportion of the epidemics of cerebro-spinal meningitis has occurred in large cities. If this is true, it is a remarkable fact, and one which needs explanation. If there is any relation between this disease and the poison of smut, the following facts may bear upon this subject.

\* Compare with Cases and Mortality from Cerebro-Spinal Meningitis, page 124.

† Quoted from *Am. Jour. Med. Sci.*, p. 540, Apr., 1864.

There is one great distinction between the source of the flour used in large cities and that used in many rural districts. Cities are supplied, in great part at least, with flour made at large mills called "merchant mills," while in rural districts much of the flour used is made at smaller mills, from wheat raised in the vicinity. In visiting mills, during my investigations, my attention has been called to the fact that there is a very great difference between the elaborate machinery employed for cleaning the wheat in "merchant mills" and the antiquated and imperfect arrangements for this purpose in many of the "custom mills." And while some of this latter class of mills are provided with ordinary smut machines, others have nothing of the kind worthy of mention.

It is not safe to rest on the assumption that because there are now elaborate and complete machines for cleaning wheat, all mills are supplied with such. This assumption is not in accordance with the facts. I was told that very near the locality where cerebro-spinal meningitis prevailed at Manchester, in this State, there is a mill that has no suitable apparatus for separating the smut from the wheat.

#### SMUT IN BUCKWHEAT USED FOR FOOD.

Some facts, which seemed to me of importance, were communicated to me by Mr. Wm. Swindells, the miller at Petersburg, where the epidemic of cerebro-spinal meningitis occurred. He said that buckwheat was more frequently than other grains affected with smut, and that it was not the custom at his mill, and I understood him to say that it was not at other mills, to run buckwheat through the smut machine before grinding it. The greatest number of epidemics have occurred during the winter and spring months; and that corresponds to the season of the year when buckwheat is most freely used. I did not succeed in finding out much about the proportion of persons at Petersburg who used this article of food and afterwards had the disease in question; but I was told that the buckwheat contained more than the usual quantity of smut, and, as before stated, it was not run through the smut machine before being ground.

Mr. Swindells also told me that it was not the custom for millers to take any measures for removing smut from corn. But, as a rule, no considerable amount of smutty corn is ground for human food.

In this connection it seems worth while to bear in mind the POSSIBILITY OF THE DISEASE BEING COMMUNICATED BY MEANS OF MILK. It is not improbable that the milk of cows fed upon grain or grass affected with smut may contain some of the poisonous material derived therefrom, especially such principles as tend to go with the oily portion, and which, from the experiments of Dr. Hooker and Mr. Wright,\* appear to be, to some extent, volatile. "He found the vapor of this preparation, diffused through the air of a close room, produced a tingling sensation of the limbs, distressing lassitude, irritability, and giddiness."\*

If milch cows eat grain or hay affected with smut, or drink it in water, it seems quite probable that the milk will contain at least a portion of the poisonous principle, as it is a well-known fact that milk is quite generally flavored by substances used as food. Act No. 26, Laws of Mich., 1873, very properly forbids the sale of milk from cows fed on refuse from distilleries

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\*Stille's Therap. Vol. II., p. 615.



or breweries; doubtless for the very good reason that such milk has been proved to be injurious to persons using it.\*

#### QUANTITY OF SMUT SEPARATED FROM WHEAT.

Perhaps this is as good relation as any in which to place another class of facts ascertained during my investigations in connection with this epidemic. I was informed that the quantity of smut and other refuse material separated from grain by the smut machines amounted to several tons at each flouring mill. There is a flouring mill at each of the two villages where this epidemic was most fatal,—Petersburg and Dundee.

The river Raisin, along which this epidemic occurred, has a large number of flouring mills on its banks. The method of dealing with smut is not quite the same in all of these mills. In many of them the smut is conveyed by a shaft into the river. In others it is simply blown out into the air. At Manchester it is thus disposed of, being discharged on that side of the mill toward the river. The mill is on the west side of the river, and just below the dam. During the summer and autumn of 1873, cerebro-spinal meningitis broke out on the east side of the river, not far below the mill. The prevailing wind in this locality is, I believe, generally from the west and southwest. There may be no relation of cause and effect between these facts; certainly no such relation is proved; but since smut is known to be a violent poison, I have thought it well to report these facts. In one of the largest mills in Jackson,—on Grand River,—the smut is collected in a tight room, and a large part of it removed to the country by a farmer who, it seems, makes some use of it. In ordinary seasons this "smut" consists largely of the little hair-like material from the small end of the wheat kernels; but in certain seasons a considerable proportion is really what is known as smut, and consists of spores of fungi.

#### WHAT IS ERGOT?

In Dr. H. C. Woods' late Treatise on Materia Medica and Toxicology, I find, on page 458, a concise statement, as follows:

"Among the lowest of vegetable organisms, and distinguished from all other plants by the absence of chlorophyll, are the fungi. There are in most cases two distinct states or stages in the life of a fungus: in the first of these, the vegetative period, it exists as a *mycelium*, a usually filamentous mass or flocculus, whose sole function is to grow and increase; in the second stage the *thallus*, or ordinary fungus or mushroom, is formed; to it is assigned the function of developing reproductive bodies, after whose formation it perishes. Between these stages there is in some fungi an intermediate one, in which the plant exists as a *sclerotium*. The genus *Claviceps* comprises a number of parasitic fungi, which develop in the pistils of the various species of Graminæ. The officinal ergot is the sclerotium of the *Claviceps* (*C. purpurea* Tulasne) which infests the grain of the *Secale cereale*, or common rye. The first appearance of the fungus is during the earliest life of the pistil, at the base of which there arises a minute flocculent mass of mycelial filaments. These filaments, continually growing and invading all parts of the tissue of the pistil, at last form of it an irregular whitish body, at the base of which, after a time, appears a dark-colored body, the sclerotium, which continues to grow, lifting up the diseased and withering mass formed out of the original pistil, and finally developing into a perfect ergot.

\* See Pages 81 to 86, Trans. Med. Soc. of N. Y. Communication of N. Y. Academy of Med., being Report of Com. on City Milk, by S. R. Percy, M. D.

"If a fresh, living ergot be placed in a damp, warm place, after a time little cracks will appear in its surface, and out through these cracks little round bodies will project, and finally be raised up on stalks, and constitute perfect thalli,—minute fungi, which finally produce spores."

This is very different from the various fungi known as "smut," this name conveying an idea of the fine, dusty blackness of the spores which in the smut known as *Tilletia caries* are produced in immense numbers in the germen of the grain itself without the production of a distinct thallus.

Taylor, in his *Principles of Medical Jurisprudence*, Vol. II., p. 184, says:

"The ergot in ordinary use is that of rye; but the ergot of wheat is said to be equally effectual, and the same perhaps may be stated of the ergot of all grasses."

Dr. Stillé says:

"Ergot is produced by other cereals besides rye. Mialhe found that the ergot of wheat is identical with that of rye in the qualities of its proximate principles and in its action upon the gravid uterus (*Bull. de Thérap.*, XXXIX., 41). His conclusions have been confirmed by Pourcher (*Ibid.*, XLVIII., 467), and by Jobert (*Am. Journ. of Med. Sci.*, Oct., 1856, p. 479)." \*

Dr. H. C. Wood says:

"It is not always the rye which causes these frightful losses of life, as Heusinger (*Journal für Pharmakodynamik*, Bd. I., p. 405) has traced one epidemic to diseased oats." †

Referring to ergot, it is stated in the U. S. Dispensatory, twelfth edition, page 365, that "It is probable that this morbid growth has similar properties from whatever plant derived; and the fact has been proved in relation to the ergot of wheat. (See *Am. Jour. Med. Sci.*, N. S., XXXII., 479.)‡ Indeed, in a case reported by Dr. D. L. McGugin (*Iowa Med. Jour.*, IV., 93),‡ this variety of ergot is said to have succeeded promptly when that of rye, previously tried, had failed." In a footnote to this last sentence it is stated that the ergot of wheat has been recommended because less liable to change, and that there is reason to believe that this is true, "for Prof. Bentley of London found that of two specimens, one of the ergot of rye, the other of wheat, which had been kept under similar circumstances for ten years, the former was quite destroyed, while the latter was apparently unchanged. Ergot is rarer in wheat than in rye; and in the head of the former there is generally but one and very rarely more than two of the diseased grains. It is produced usually in wheat in wet seasons, and on that side of the head most exposed to dampness. It is shorter and much thicker than the ergot of rye, being about half an inch long and three-quarters of an inch or more in circumference, and cleft into two or three divisions. In color and smell it resembles the spurred rye. (*Pharm. Jour.*, March and April, 1863, pp. 423 and 442.)" †

On page 485, Chapman's *Therapeutics*, Vol. I., 1825, I find the following relative to the production of ergot. "The Abbe Fontana planted a number of single grains of rye, and upon the top of each placed several grains of ergot. The result was a crop of this substance, showing something similar to infection."

#### WHAT IS THE "SMUT" WHICH AFFECTS DIFFERENT KINDS OF GRAIN.

In this part of the world very many different kinds of fungi are commonly designated simply as "smut." We hear of "smut wheat," "smut corn,"

\* *Therapeutics and Materia Medica*, Vol. II., p. 607.

† *Materia Medica and Toxicology*, p. 469.

‡ I regret that I have not been able to see the original papers referred to above.

"smut buckwheat," and occasionally of "smut grass." Although these are known to mycologists as belonging to different species and genera, they have certain general characters in common; they are "parasitic on living plants," and most of them, as also the "brands" and "rusts," belong to the order *Cœomacei*.\*

One of these well known to farmers is the "smut" which is found in wheat after it is threshed, the kernels affected being not very different from the perfect wheat in external appearance, but which are filled with myriads of black spores. In England this seems to be commonly known as "bunt," and in works on fungi, as *Tilletia caries*, the first name indicating the genus and the last the species. As before mentioned, it belongs to the order *Cœomacei*, which is included in the family *Coniomycetes*, while ergot of rye—*Claviceps purpurea*, belongs to the order *Sphæriacei*, and family *Ascomycetes*. According to Berkeley, one of the best authorities on such subjects, "This family [*Coniomycetes*] is distinguished by the vast predominance of the reproductive bodies over the rest of the plant, if not in size, at least in abundance, and from the ease with which, in general, they fall from the point of attachment, in consequence of which, as the name implies, they have a dusty appearance, and often soil the fingers of those who handle them." †

Unfortunately this character admirably fits the members of this family to maintain their existence. Rev. M. J. Berkeley of England has experimented with the spores of *Tilletia caries*, and ascertained that their germination proceeds through the development of four successive generations. In Cooke's *Introduction to the Study of Microscopic Fungi*, this process is briefly described as follows: "When these are made to germinate, a kind of stem is protruded, upon which small clusters of elongated thread-like spores of the second generation, or sporidia, are produced. After a time the spores conjugate, or become united by short transverse processes in the same manner as has been observed in some of the lower forms of algæ. The conjugated spores in the next stage germinate and produce a third kind of fruit, different from either of the preceding, and constituting a third generation. These in turn germinate and produce a fourth order of re-productive organs, so that in the process of growth the 'bunt' spores evidently pass through four generations. Hence, as one result, the number of germinating bodies is greatly increased, as well as their power of inflicting injury in a corresponding diminution of size. There are still many points in the history of the growth and development through successive generations of the 'bunt' spores, but enough is known, on the one hand, to show that this is a true vegetative parasite, and not merely a diseased condition of the tissues of the wheat plant, and on the other, that it is perfectly distinct from all the phases of the other and similar parasitic fungi which affect the wheat crop." ‡

There is a growing belief that "like causes produce like effects," and it is a fact worthy of attention that so many diseases which are in many respects similar, have been attributed to fungi which are also different from, but have many things in common with each other. A few years since the Texas cattle disease was quite thoroughly studied by the Board of Health of the city of New York, and, although the cause was not certainly proved, yet there was some reason to believe that it might be a fungus taken in with the food of the animals. Great numbers of "micrococci" were uniformly found present in the blood and bile of the diseased animals, and it was claimed that these

\* *Hand-Book of British Fungi*, Vol. II., p. 511.

† *Hand-Book of British Fungi*, Cooke, Vol. I., p. 414.

‡ *Rust, Smut, Mildew, and Mould*, Cooke, pp. 53, 59.

micrococci could be and were artificially developed into a mature fungus. This fungus is figured and described in the report of the New York Board of Health for 1868, which also contains a very complete account of the disease. (Drs. Billings and Curtis, of Washington, D. C., have tested the development of the micrococci, and did not verify the statement.\*) The symptoms of the disease as well as the *post-mortem* results were similar in many respects to the disease being studied in this report. It began with a chill or cold stage, after which the temperature was increased; there was delirium, the neck was not thrown back, but the head was retracted or straitened on the neck, there was retraction of the abdomen,—“tucking up of the belly,”—constipation, difficulty in urinating, and, frequently, bloody urine; after death numerous ecchymoses were found in different parts of the body, and occasionally extravasations of blood; there was enlarged spleen.† “In three instances the condition of the brain was carefully examined, because it was presumed that those particular cases might be found to have suffered from acute meningitis or from cerebral congestion. No trace of actual inflammation was found, but there was evidence of congestion of the cerebral vessels in two of the cases. The medulla oblongata was examined in these cases, and sufficient effusion was found in one instance to have produced morbid, nervous, and muscular phenomena. Yet the observations finally led to the conclusion that all, or nearly all the delirious actions, distorted movements and postures, and comatose conditions that characterized various cases, were attributed to the toxæmia which constitutes the essential quality of the disease.”‡ We see here a conclusion similar to that by most writers as regards cerebro-spinal meningitis, namely, that many of the symptoms referable to the cerebro-spinal system are not due to an inflammation therein, but to blood-poisoning. It seems to me that a more rational explanation would be to let the actual *post-mortem* results, such as congestion of the veins and sinuses of the brain and spinal cord, ecchymoses and extravasations of blood, account for much of the nervous disturbance, and then let the excessive muscular contraction, which is also evident, account for the forcing of blood into the veins in such situations, as also into the spleen, which is found softened as well as enlarged.

As pointed out in another part of this report, the known action of some of these fungi is to cause muscular contraction, particularly of the involuntary muscles, and it would not be inconsistent with this knowledge if it should turn out that the Texas cattle disease was due to a fungus taken into the bodies of the animals.

In 1862, J. H. Salisbury, M. D., of Newark, Ohio, communicated to the American Journal of the Medical Sciences, a paper on fungi, with an account of experiments showing the influence of the fungi of wheat straw on the human system. He inoculated several persons with spores obtained from wheat straw allowed to ferment by means of heat and moisture. “From the inoculations as far as they have gone, in from twenty-four to seventy-two hours, the effects begin to show themselves in lassitude, chilliness, catarrhal symptoms, and pains through the forehead and temples.”§

The symptoms which he describes are: Chills, followed by fever, pain in the head and back, nausea, fullness and throbbing in the head, deafness, sneezing, sensitiveness sometimes amounting to inflammation of the eyes,

\* Report U. S. Com'r of Agriculture on Diseases of Cattle, 1869-70, pp. 156-170.

† Enlarged spleen has been mentioned as one of the *post-mortem* evidences in cerebro-spinal meningitis.

‡ Report Bd of Health of N. Y. City, 1868, p. 284.

§ Am. Jour. Med. Sci., July, 1862, p. 27.

burning congestive feeling in the scalp, oppression in the chest, dryness and soreness of the throat, hoarseness, coughing, redness in spots under the skin, and an eruption somewhat similar to that of measles, these manifestations disappearing after about eight days.

In this same article the following statement appears:

“At the monthly meeting of the ‘Farmers’ Club,’ near Newark, Ohio, last month, several of the farmers stated to Mr. Dille that it was quite common, after threshing wheat, for persons who had been exposed much to the dust, to be taken with severe chills, followed by a high fever, catarrhal symptoms, and an eruption on the face. None of them could state that any one had ever had the attack twice; nor whether they had known any cases to follow the threshing of any other kind of grain than wheat.

“It is well known among swine growers that when they bed their hogs in straw they are affected with an eruption in the throat, fauces and roof of mouth, accompanied with coughing.”\*

The fungi figured and described by Dr. Salisbury as found on straw allowed to “heat” or ferment, although somewhat similar, were different from any others which have been mentioned in this report.

On page 241 of his work on Food and Dietetics, Dr. Pavy says:

“Bread also becomes the seat of development of certain species of fungi—(*Penicillium oidium*, etc.)—in other words, becomes mouldy on keeping, and the more quickly so in proportion as it contains water. The same likewise happens with wheat and flour under the presence of moisture. The existence of this low form of vegetable growth renders the articles pervaded dangerous for use. They are liable to produce injurious and even fatal consequences. Dr. Christison states that on the continent repeated instances have occurred of severe and even dangerous poisoning by spoiled or mouldy rye bread, barley bread, and wheat bread; and that several instances have been observed of horses having been killed in a short space of time with symptoms of irritant poisoning by eating such bread with their ordinary food. It has further been noticed that the consumption of mouldy oats has been followed by fatal consequences. Dr. Parkes [*Pract. Hygien*, 3d Ed., p. 223], quoting from Professor Varnell, states that ‘six horses died in three days from eating mouldy oats; there was a large amount of matted mycelium, and this, when given to other horses for experiment, killed them in thirty-six hours.’”

#### EFFORTS TO TRACE THE CAUSE OF SOME PREVIOUS EPIDEMICS.

Cerebro-spinal meningitis prevailed at the State Reform School near Lansing in 1863 and again in the winter of 1865-6. I have been unable to learn much concerning the conditions existing at that time. There seems to have been some complaint in regard to the insufficiency of the clothing of the boys, and of the coldness of the dormitories where they slept. It has not yet been proved that cold or the reaction therefrom is sufficient of itself to cause the disease, but the fact that a large proportion of the epidemics occur in the winter and spring would seem to indicate this as one of the factors, and there is other evidence tending to the same conclusion. An effort was made to ascertain the source of the breadstuffs used at the Reform School at that time. Application was made to the Superintendent for this information, but after the lapse of a considerable time his reply was that he had been unable to learn that fact. There is, however, indirect evidence bearing upon the subject, so far as

\* *Am. Jour. Med. Sci.*, July, 1862, p. 22.

relates to the winter of 1865-6. It is stated by numerous authorities that ergot of rye is more prevalent in wet than in dry seasons, and this seems to be true of many of those species of fungi which attack the different kinds of grain. Now the character of the season in Michigan during the time when the cereals used for food in the winter of 1865-6 were ripening and being harvested was unusually wet, and in addition to the inference that the fungi which attack wheat would be likely to be present, we find a statement of the presence of some of them.

"This year [1865], over a large portion of the State, *particularly the central and western*,\* the summer and early autumn were so wet as to seriously injure some farm products." \* \* "Through the summer of 1865 rain fell at short intervals, and with the constantly damp atmosphere which prevailed, even the surface of the ground was scarcely dried." \* \*

"According to the returns received by the Commissioner of Agriculture, Washington, D. C., the deficiency in the yield of wheat in the country for 1865, as compared with 1864, is 12,172,994 bushels. It will be observed that this relates only to the *quantity* of the crop. Its quality is inferior throughout the Western States." \* \* In this State, "*rust, also, made its appearance on many fields*,"\* induced, probably, by the prevalence of wet weather, alternating with warm sunshine. Add to these casualties the injury from rains after the crop was cut, and the depreciation in the *quality* of the grain must be obvious, though not easily stated in figures."†

The winter of 1865-6 is said to have been "a dry and rather cold winter."‡

As regards the prevalence of the disease at the Reform School during the winter of 1865-6, it appears to be, at least, possible that it may be accounted for by the facts just stated, and which may be summarized as follows: Throughout that part of the State from which its food supply was probably derived, the grain raised in 1865 was of poor quality because of the fungi which attacked it during the wet and warm summer months; the winter of 1865-6 was dry and cold; the inmates were not warmly clothed, and their dormitories were unusually cold.

It is much to be regretted that the conditions of the crops and seasons preceding and during the outbreak of 1863 were not recorded in some State publication, but at that time the State Board of Agriculture was only just organized, and had not begun that work.

It has been remarked that the fungi which destroy wheat and other grains are most destructive during wet seasons, but it will not answer to conclude that they are present in every wet season, for heat is also required for their most active growth. In examining with reference to wetness of season during ripening of grain, it will be seen that the summer of 1866 was unusually wet, and the question may arise, why did not cerebro-spinal meningitis prevail in the winter of 1866-7, if the fungi of cereals are factors in its causation. By referring to the statement of crops in this State in 1866, it is found that although the wheat crop was below the average yield, and was to some extent damaged by heating and sprouting in the stack, still, where not injured in this manner, it *was of "good quality,"* and there was no mention of rust or smut, the season being wet, but cool.

Epidemic cerebro-spinal meningitis prevailed in Philadelphia and vicinity

\* Italics mine.

† Report of Secretary of the State Board of Agriculture of Michigan, for the year 1865, pp. 7, 8, 9, 10.

‡ Report of Secretary of the State Board of Agriculture of Michigan, 1865, p. 88.

during the winter of 1863, and spring of 1864. The meteorological conditions observed at Philadelphia in spring and summer of 1863, were as follows: "The amount of rain that fell during the spring and summer [of 1863] was 28.542 inches, being 8.210 more than 1862, while the number of days it rained amounted to 82, which exceeded the number in 1862 by 20 days. The seasons, therefore, have been uncommonly wet."\* From meteorological observations by Prof. J. H. Kirkpatrick of the Philadelphia High School, published in same journal as above, I learn that for the month of June, 1863, the maximum temperature was 91.5 deg., the mean temperature was 69.48 deg., the average dew point was 54.43 deg. This evidence is not very valuable as it is, but may lead to the bringing forth of some more conclusive one way or the other. It is not probable that the city was supplied to any great extent by food derived from cereals raised near the city, and yet the comparatively few persons in the city who contracted this disease may have used the same food as did those in the various villages near by, and which may have been raised in that vicinity; or the milk used may have been from cows fed on hay made and cured in that vicinity during that warm and wet summer of 1863. The question which I wish to present, and ask evidence concerning, is this: Does cerebro-spinal meningitis usually appear during or following an unusually cold winter following an unusually warm and wet summer during which fungi were caused to pervade the cereals and grasses afterwards directly or indirectly used for human food?

An epidemic which occurred at Elmira, New York, in 1857, has been mentioned in this report. An effort to learn the condition of the wheat raised in 1856 proved unsuccessful. W. A. Armstrong, Secretary of the Elmira Farmers' Club, writes as follows: "I am sorry to say no precise information is attainable. I have accurate knowledge of my own crop for that year, but I was not then a resident of this county. I have inquired of old farmers here about the characteristics of that season's crop, but there are only vague impressions regarding its character; these, however, seem to indicate an unusual amount of smut."

So far as I can learn from the Vital Statistics of Michigan, the deaths from cerebro-spinal meningitis in this State appear as follows: During the year 1868, 7 deaths; 1869, 5 deaths; 1870, 9 deaths; 1871, 18 deaths; 1872, 248, including those returned as from "meningitis," etc. For the year 1873 the returns are not yet all in, and for 1874 the deaths are not yet collected by the supervisors, but judging from the best evidence at hand it seems probable that in 1873 there were more deaths from this cause in this State than in any previous year, and more than in 1874.

By careful examination of the Reports of the State Board of Agriculture, I find that it is not the uniform custom of the correspondents in different parts of the State to record the diseases which affect the crops, or the peculiarities of the seasons, although these subjects are occasionally mentioned. So far as relates to the wheat crop for the year 1870, the following is about the only positive record of its quality being affected: "The wheat crop was more than an average yield, but, owing to the wet season, was somewhat damaged."†

In some parts of the State it was reported as of good quality.

For the year 1871, so far as shown by reports printed in the Report of the State Board of Agriculture, the wheat crop was of excellent quality.

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\* Am. Jour. Med. Sci., July, 1864, p. 96.

† Report Sec'y Ingham Co. Agr'l Sec., in Report of Sec'y of State B'd of Agriculture for the year 1870.

For the year 1872, there is very little said in the Report, the following being about all of consequence, and showing that it was of good quality in some localities and not good in others.

"A few showers before harvest time, 1872, just when the plant was in its most susceptible condition to be most affected, caused rust. In consequence, the crop was almost a failure; the quantity being light, and quality but second rate."\*

"The spring [1872] opened very late, the summer was very hot, and after the first of June, very dry."

"The wheat crop was considerably more than an average in quantity, and the quality was excellent."†

But in the same Report I find a record of extraordinary meteorological conditions during the winter of 1872-3, which may bear upon the subject of the unusual prevalence of cerebro-spinal meningitis in this State, in December, 1872, and spring of 1873.

"The month of December [1872] was more than 8 deg. below the average temperature of that month,‡ a fitting forerunner of the terribly cold winter of 1873. The period from December 23d to 25th will long be remembered as the severest 'cold spell' ever witnessed in our State. On the morning of the 24th of December the thermometer stood at 32 deg. below zero. This extreme cold was not confined to our State, but appears to have swept as a polar-wave from Pembina in a southeasterly direction across Minnesota, Wisconsin, and Michigan, thence easterly across Ontario and New York, and thence northeasterly to Quebec. The damage to fruit trees and the suffering which it caused to all classes will not soon be forgotten."§

Now although it is so difficult to obtain any reliable information regarding the diseases of the cereals within late years, it happens that I have been able to learn of a very remarkable blight of the wheat crop in Europe in 1804,—the year preceding a well-recognized outbreak of epidemic cerebro-spinal meningitis in Europe. On page 13 of his work on the subject of this disease, Dr. Stillé says: "The first account of epidemic meningitis within the period we have referred to was published in 1805, by Vieusseux, who at once declared that neither he nor any of his colleagues had ever seen a similar disease." Although that outbreak began in Europe in 1805, it did not begin in this country until the following year, at Medfield, Massachusetts. Of the quality of the cereals in this country at that time I have found no mention, but, in Loudon's *Encyclopædia of Plants*, published in London, 1836, page 1048, one may read that "the alarming state of the harvest of August, 1804, from what is vulgarly called blight, induced Sir Joseph Banks to have some blighted stalks of wheat examined under a powerful microscope, and drawings made from them by Mr. Francis Bauer. These were published in a pamphlet in January, 1805." The figures of the fungi in the *Encyclopædia* are copied from this work of Sir Joseph Banks. Whether or not the disease prevailed in the immediate vicinity where the affected wheat was raised I have not been able to learn. Dr. Meredith Clymer says: "In Prussia, Holland, Rhenish

\* Twenty-third Annual Report of the Board of Management of the Genesee County Agr'l Society, in "Report of Sec'y of Mich. State Board of Agriculture" for the year 1872, p. 185.

† O. H. P. Sheldon, Secretary of Van Buren County Agr'l Society, in Report Sec'y State B'd of Ag., 1872, p. 162.

‡ Prof. Kedzie has kept a thorough meteorological record at the College since 1864.

§ Prof. R. C. Kedzie, in Report of Sec'y Mich. State Board of Agriculture for the year 1872, p. 290.



Germany, Bavaria, and Eastern France, there were occasional outbreaks of the disease from 1805 to 1815.”\*

SOME POST-MORTEM APPEARANCES WHICH NEED EXPLANATION.

Without attempting to deny that in some cases of this disease evidences of inflammation of the meninges of the brain and spinal cord are found, it nevertheless seems true that in a large proportion of the records of *post-mortem* examinations no satisfactory evidence of this appears. Thus, in a case reported to the College of Physicians of Philadelphia by Dr. Jewell in 1864, and which appears to have been a well-marked case of this disease, the patient died after an illness of 48 hours. Omitting references to other organs: “On cutting through the scalp the blood flowed away more freely than usual, and it was found that it was abnormally fluid within the veins. The vessels of the dura mater were remarkably congested with fluid blood, very dark in color. A yellow effusion existed in the subarachnoid space; it proved to be of a serous character, and to exist in the spinal canal also.”†

Dr. Levick reported the case of a child that died on the first day of the disease where “On removing the calvaria a large ecchymosis was found under the pericranium near the sagittal suture. The vessels of the dura mater were filled with dark fluid blood, which could readily be pushed aside by the handle of the scalpel. The substance of the brain and of the medulla oblongata was natural in its appearance and consistence. There was no effusion in the ventricle, and the most careful examination failed to detect the slightest evidence of inflammatory exudation.”‡

In the American Journal of the Medical Sciences for October, 1865, page 509, is an abstract of Prof. Menderlich's observations on the epidemic in Germany in 1864-5, wherein the following remarks occur: “It is particularly worthy of remark that although many phenomena of this affection are explicable by the lesions found in and about the nervous centres, yet many others are present which cannot be referred to those lesions, which indeed are not themselves uniformly proportioned in extent to the gravity of the symptoms. Hence we must be convinced that cerebro-spinal meningitis is rather a constitutional than a local disease, and one whose symptoms are not to be explained merely by a reference to its anatomical lesions alone.” \* \* “It is precisely the severest cases which hurry on without remission to a fatal close, and in which the slightest anatomical alterations are discovered, or, indeed, cannot be detected at all.” \* \* “Cases occur in which it seems as if the life of the body in all its parts perished by a sudden and deadly intoxication.”

On page 278 of the same journal for July, 1865, is an account of an autopsy of a woman who died twelve hours after she had gone to bed apparently in her usual health. It is reported by James J. Levick, M. D., one of the physicians of Pennsylvania Hospital, as a case of “spotted fever without cerebro-spinal meningitis.” “On cutting through the scalp there was an escape of dark fluid blood with which the vessels were turgid. A large ecchymosis was found on the left temporal bone, and smaller ones on other parts of the cranium. The meningeal vessels were filled with black blood. The most careful examination failed to detect any evidence of inflammation either in the substance of the brain or in its membranes. The spinal cord was removed in its entire length,

\* Cerebro-Spinal Meningitis, p. 6.

† Am. Jour. Med. Sci., July, 1864, pp. 180, 181.

‡ Am. Jour. Med. Sci., July, 1864, p. 186.

and was examined both by the unassisted eye and with the microscope. It was of firm consistence, and in every way free from disease."

In Dr. Moreau Morris' article in the report of the Board of Health of New York city for the year 1871, page 359, is an account of the *post-mortem* appearances in a case that died eighteen hours after first attack. "The serous and mucous coats of the stomach showed purpuric spots similar to those on the body. It was also scattered, though less abundantly, over the peritoneal coat of both large and small intestines. Lungs, heart, liver, and kidneys were healthy. The blood was very fluid. The whole of the surface of the brain was intensely congested, the veins and sinuses being gorged with very fluid blood, though not entirely devoid of coagula. On section of the brain little points of blood netted out everywhere. The ventricles were nearly dry. Consistence of brain natural; no exudations or purulent matter found."

It is to be regretted that the microscopical appearances of the blood-vessels of the brain and spinal cord have not been generally recorded. If any such records have been kept I have failed to find them. But from such records as those just preceding, one would expect to find some such condition of the smaller blood-vessels as described by Dr. Dickenson in tetanus, and quoted in another part of this report. Prominent facts to be accounted for are the ecchymoses, or extravasations of blood which seem to take place in various parts of the body, and the engorgement of the veins and sinuses of the brain with black blood. In the most severe cases, where death takes place most rapidly, these have been the most apparent causes of death. It is difficult to see how blood can get outside of the vessels as it does in this disease except one of two things is true. Either there must be some unusual rottenness of the walls of the vessels, or they must be subjected to unusual strain. And this even though the blood be rather more than usually fluid, for passive hemorrhages are not common in this disease. It seems reasonable to conclude that the ecchymotic spots and the venous engorgement of the brain are both due to unusual blood-pressure in the vessels, and that this is due to general muscular spasm, or tonic contraction.

#### CERTAIN FACTS IN ANATOMY WHICH MAY BEAR UPON THE CAUSE OF THIS DISEASE.

"The diameter of the capillaries varies in different tissues of the body, their usual size being about one three-thousandths part of an inch. The smallest are those of the brain, and the mucous membrane of the intestines; the largest those of the skin and the marrow of the bones."\*

This seems to have a bearing upon the view that in cerebro-spinal meningitis there is primarily a starved condition of the cerebral tissue, through excessive contraction amounting to almost entire obliteration of the minute blood-vessels. Such contraction has elsewhere been suggested as the cause of the dry gangrene in one form of ergotism. The smallest capillaries being those of the brain and mucous membrane of the intestines, we might expect that the contraction of blood-vessels would be most serious in its effects upon those tissues; more particularly in the brain for the reason that it would suffer not only from small supply of blood, but also from impoverished blood, because of the impoverished intestinal circulation interfering with digestion. It will not answer, however, to assume without further proof that the tension of the walls of the blood-vessels is the same in all parts of the body. There

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\* Gray's Anatomy, p. 260.

are other points to be considered before coming to a conclusion as to the relative quantity supplied to the brain under such circumstances, for the tendency or power of contraction may be much greater in some parts than in others, in which case extraordinary distention might result where the contraction of the walls was least.

The fact that the largest capillaries are those of the skin, may have some connection with the appearance of spots and ecchymoses in this disease. The extent of tissue supplied by each capillary may also bear upon the subject of death of parts. "In the liver and lung the interspaces are smaller than the capillary vessels themselves. In the kidney, in the conjunctiva, and in the cutis, the interspaces are from three to four times as large as the capillaries which form them."\*

Such contraction of muscular walls of blood-vessels as is believed to result from the action of ergot and of cold would impede the general circulation, and would tend to force the blood into situations where the vessels were least supplied with muscular walls.

"Some arteries have extremely thin coats in proportion to their size; this is especially the case in those situated in the cavity of the cranium and spinal canal, the difference depending upon the greater thinness of the external and middle coats." \* \* "Some arteries, as those in the cranium, are not included in sheaths." \* \* Arteries are also provided with nerves; they are derived chiefly from the sympathetic, but partly from the cerebro-spinal system. \* \* "According to Kölliker, the majority of the arteries of the brain and spinal cord, those of the choroid, of the placenta, as well as many arteries of muscles, glands, and membranes, are uprovided with them."†

We have been examining the structure of arteries and capillaries; congestion of veins in certain parts would result from contraction of muscular walls of blood-vessels.

"Muscular tissue is wanting in the veins: 1. Of the maternal parts of the placenta. 2. *In most of the cerebral veins, and sinuses of the dura mater.* 3. *In the veins of the retina.*‡ 4. In the veins of the cancellous tissue of bones. 5. In the venous spaces of the corpora cavernosa. The veins of the above-mentioned parts have an internal epithelial lining, supported on one or more layers of areolar tissue."

"Most veins are provided with valves, which serve to prevent the reflux of the blood." \* \* "The cerebral and spinal veins, the veins of the cancellated tissue of bone, the pulmonary veins, and the umbilical vein and its branches, are also destitute of valves."||

#### ATTEMPT TO ACCOUNT FOR THE EXUDATION SOMETIMES FOUND.

If we accept the evidence which seems conclusive of the contraction of non-striated muscles through certain influences, such as cold, ergot, and similar fungi, and bear in mind the pressure which under the action of such agents, would be exerted upon the walls of blood-vessels not well supplied with muscular tissue and not protected by valves, we may have some conception of the possibility of the effusion of serum, the exudation of fibrin, and the extravasation of blood in such situations, which, it will be seen by the quotations from Gray's Anatomy, are, more particularly, the brain and spinal cord. This

\* Gray's Anatomy, p. 861.

† Gray's Anatomy, p. 860-1.

‡ Italics mine.

Gray's Anatomy, p. 457.

must not be assumed as proof that in this disease the exudation upon the cerebro-spinal membranes is actually caused in this manner. It is offered as a possible explanation, which must be verified or disproved by future investigation. In the same spirit we may offer an EXPLANATION OF THE SOFTENING OF THE BRAIN AND SPINAL CORD which is usually found in patients dead from cerebro-spinal meningitis. Stillé says: "The *substance of the brain* is generally softened." He mentions the observations of numerous writers to establish this point. "*Softening* of the spinal marrow appears to be less frequent than that of the brain."\* Nevertheless he mentions several cases, and says: "Partial and superficial softening of the cervical portion we have seen repeatedly."\* Speaking of cerebral softening, Dr. Hammond says: "Most authors treat of it in direct connection with obliteration of the cerebral arteries, but, although frequently due to this cause, it may be produced by others."† Now if the general contraction of all blood-vessels well supplied with muscular walls does not result in a great contraction of the vessels within the brain and spinal cord, and in that manner, deprive the brain of its nutriment, there seems to be good reason for believing that there would be congestion not only of the thin-coated arteries of the brain and spinal canal, but also of "most of the cerebral veins" in which Gray says "muscular tissue is wanting." Such a condition of arterial and venous congestion would not be favorable to repair of nervous tissue, and conjoined with a sluggish circulation, would go far toward explaining the softening and disintegration of the brain and spinal cord, especially as the blood would be impoverished because of the difficulty of getting nutriment into it through vessels in such tonic contraction.

Some recent experiments on rabbits seem to show that in them ergot causes contraction of the vessels of the brain, as well as of other blood vessels. "Dr. Max Schuler—*Berl. Klin. Wochenschrift, Chicago Jour. Nervous Diseases*, Oct. 2, 1874, records some experiments," which, although not conclusive as to the action of the substances named upon man are worthy of attention. "He found that *after the continued application of large sinapisms the cerebral vascularity was reduced.*" "Dr. Schuler, experimenting with nitrite of amyl, as with mustard, was able to demonstrate the hitherto supposed action of this drug, viz.: that it *relaxed the cerebral vessels.*" "Dr. Schuler demonstrated that injection of ergotine was followed by a powerful and continued vascular contraction at the place of injection, and in both the arteries and veins of the pia mater." He found that "ergotine would contract the cerebral vessels when they were dilated to their fullest extent. On the contrary, nitrite of amyl would not dilate vessels contracted by ergotine." "He found that ergotine would contract arterioles when the sympathetic nerve supplying those arterioles was divided. Thus we have direct proof that ergotine acts on the muscular fibre of the arteriole."‡

It may be remarked that, although ergot may cause contraction of the blood-vessels of the brain, as also of all other blood-vessels having muscular walls, including the heart, the contraction of those vessels having the least muscular fibre must yield to the stronger contraction of those having the greatest amount of muscular fibre, and as elsewhere pointed out, the muscular walls of the arteries of the brain and spinal cord are thin, and the veins in those parts have no valves.

\* Stillé on Epidemic Meningitis, p. 89.

† Diseases of the Nervous System, p. 187.

‡ Detroit Review of Medicine, February, 1875, p. 108.

A careful study of the account of the experiments referred to above shows that the immediate effects of these agents was different from the effects of their continued influence. Immediately, and for a short time after the influence of the mustard began, there was an alternation of contraction and dilation, resulting at last in a permanent contraction, under the full influence of the substance. In another part of this report, while endeavoring to account for the two different sets of symptoms caused by ergoted grain, I suggested that perhaps the so-called spasmodic ergotism resulted from alternate contraction and dilation of the blood-vessels through the influence of food containing the fungus, modified by varying conditions of heat and cold, position of the body in sleep, etc. It will be remembered that the symptoms of spasmodic ergotism are similar in many respect to those of cerebro-spinal meningitis. In connection with the experiments mentioned above, I recall the suggestion just referred to for the purpose of studying the subject a little more closely since the statement of certain facts which have been made to follow that part of the paper in which the suggestion occurred. It may now be studied in connection with the question: CAN SOME SYMPTOMS OF MENINGITIS BE EXPLAINED THROUGH ALTERNATE CONTRACTION AND DILATION OF BLOOD VESSELS?

The probable result of such changes may perhaps be better stated in the form of propositions, as follows:

1. The brain and spinal cord are normally surrounded by a fluid.
2. The cranium and spinal canal are rigid, and their contents are of nearly uniform bulk.
3. When the blood-vessels of the brain and spinal cord are greatly contracted, the extra space thus left within the cranium and spinal canal is probably filled by an extra quantity of fluid.
4. Under such conditions, if the blood-vessels are suddenly dilated, there will be pressure upon the brain and spinal cord.

Some of the prominent symptoms of this disease would be accounted for through compression of the spinal cord and brain. In another part of this paper, while speaking of cold and changes in temperature, it was remarked that some of the prominent symptoms of this disease would be accounted for by irritation of the pneumogastric and spinal accessory nerves near their origin within the spinal canal. If the foregoing propositions are correct, we should have the conditions for mechanical irritation through pressure upon the nervous substance wherever there was sudden dilation following extreme contraction of the blood-vessels of any considerable portion of the brain and spinal cord; and it seems reasonable to conclude that the pressure would be most severe in its effects at the points of dilation. Other things equal, this dilation would be great where there was least normal stimulation of vaso-motor nerves, and greatest where there was entire suspension of function of such nerves, through division or complete reaction from previous over-excitation. Prof. Flint says that "the local circulations are regulated in accordance with impressions made on sensory nerves,"\* etc. I have elsewhere called attention to the fact that, under ordinary circumstances, cold is not allowed to strike the body except in the air passages. During the inspiration of cold air the blood which goes to the lungs must lose heat rapidly. We have seen that cold is one of the most important agents in causing contraction of muscular tissue. Can there be any doubt that it has a powerful influence upon the nerves distributed

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\* Physiology, p. 489.

to the lungs and heart? If it has, then such sudden changes as that from breathing the cold external air of winter to breathing that of a warm room should cause a corresponding change in the "local circulation" of that part of the brain and spinal cord from whence those nerves are derived. Under ordinary circumstances this causes, at the most, only some giddiness; but through the excessive influence of ergot, or a fungus having similar properties of powerfully influencing the contraction of blood-vessels, it may be possible for the added influence of cold to produce extraordinary contraction, and this to be followed by an equally extraordinary dilation of the blood-vessels, because of almost complete paralysis of the nerves so exposed when they are again brought under the relaxing influence of heat. The nerves of the face and air passages would be most exposed to cold, and, therefore, to reaction therefrom. There may be some relation of cause and effect between these facts,\* and the symptoms of giddiness, nausea and vomiting, dilation of pupils, tetanoid contractions of muscles of the neck, etc., so frequently found in cerebro-spinal meningitis.

There is reason to believe that cases of cerebro-spinal meningitis and tetanus are sometimes confounded. There are cases of meningitis on record which if there had chanced to have been a previous wound might, consistently, have been reported as tetanus. The question arises whether tetanus is not a similar form of disease which is usually caused in great part by physical pain. Let us study the action of pain. Under the influence of severe pain there is usually a marked contraction of voluntary muscles. There is what is called a "straining of every nerve." The whole muscular system is in a state of unusual tension. In health, the circulation in the veins is largely carried on by the alternations of pressure and relaxation which the muscles exert upon them during ordinary healthful conditions, the valves in the veins preventing the blood from flowing from the heart. Given a state of continuous unusual muscular tension, such as sometimes results from wounds, there would be a corresponding tension in those blood-vessels least compressed by muscles. Those in the cranium and spinal canal are the ones, as previously remarked. Fortunately facts have been recorded which bear directly upon this subject. The microscopical appearances of the spinal cord in tetanus are described by Dr. Dickenson: "The blood-vessels appear to be, if not the first, at least an early seat of change. Distended with blood, not only to their uttermost natural capacity, but dilated to many times their proper width, and crammed with blood corpuscles so as to look like solid cylinders, their condition gave evidence of an altogether abnormal relation between the pressure of the blood and the resistance of the walls. Either blood had been propelled into them with supernatural force, or what is more likely [?], the tension of their coats had been lessened by a change in their innervation. The overcharge of the vessels led to the escape of their contents. In some cases blood corpuscles were extruded. More often only the fluid portion of the blood traversed the wall, to appear as the translucent structureless material which played so prominent a part in the destruction of the cord." \* \* "At the same time a certain amount of disintegration of the nervous elements had taken place, where the exudation came into contact with them, such as might result if, as suggested by Mr. Lockhart Clarke, the exudation had a solvent action upon the tissue. It is probable that the tendency to disintegration in the nervous matter may have been enhanced by the unnatural state of the blood-vessels, and the consequent imperfect nutrition of the cord." †

\* Another point to be borne in mind is the vaso-motor centre, supposed to be in the medulla oblongata.

† Am. Jour. Med. Sci., April, 1869, p. 469.

An attempt to study and explain the cause of tetanus was not the primary object of this report. But it has been found necessary to study this and other allied affections in order to appreciate the evidence as to the cause of cerebro-spinal meningitis. Prof. Gross says: "The term tetanus is a generic one, employed to denote a peculiar affection of the nerves, characterized by violent contraction of the voluntary muscles, with irregular intervals of partial, though seldom of complete, relaxation."\*

The several species of tetanus are: *trismus*, or locked jaw; *opisthotonos*, when the body is bent backward; *emprosthotonos*, when it is bent forward; *pleurothotonos*, when it is drawn to one side; *trismus nascentium*, or infantile tetanus, a few days after birth. Trismus and opisthotonos are frequently prominent phenomena in cerebro-spinal meningitis, and there is no reason to believe that these species of tetanus are then caused in a very different manner than when they follow a wound. Not a very large proportion of all wounds are followed by tetanus; something more than an ordinary wound is therefore needed. Prof. Gross says: "The fact is, in persons of a nervous, irritable temperament, any injury, however trifling or insignificant in itself, may readily induce the disease, especially in hot and damp states of the atmosphere, or during sudden transitions from heat to cold. Exposure to cold draughts, by which the body is suddenly chilled, is, under such circumstances, extremely liable to provoke an attack. The effect of cold air, when permitted to play directly upon the body, is well illustrated by an occurrence that took place after the battle of Ticonderoga in 1758. The wounded were exposed the whole night after the action, in open boats, upon Lake George, and the consequence was that nine of them died of locked jaw."†

The combined influence of cold, pain, fear, or unusual nervous susceptibility, is probably sufficient to cause such muscular tension as to force the blood into the feebly resisting blood-vessels of the brain and spinal cord, and to produce the condition described by Dr. Dickenson quoted above. When we remember the "extremely thin coats" of the arteries of the brain and spinal cord, it seems evident that the direct action of any agent, such as ergot, that undoubtedly produces marked contraction of the blood-vessels, would be toward the production of just such a condition of the brain and spinal cord as is described above, as found in tetanus. To deny this seems to me like denying that "motion occurs in the direction of least resistance." It seems reasonable to conclude that the use of ergot in food or medicine would tend toward the production of tetanus. Seeking the cause of tetanus is also seeking the cause of part of the phenomena of cerebro-spinal meningitis. But in this last mentioned disease there are additional phenomena which it has been thought were best explained by the influence of some "blood-poison." It should be borne in mind, however, that while in tetanus caused by a wound in connection with cold, the spinal congestion is caused in great part by the extraordinary tonicity of the voluntary muscles combined with the unusual contraction of the vessels of the surface of the body, in the spinal congestion which I suppose to be, under certain circumstances, caused by ergot and substances having similar action upon involuntary muscular fibre, we may have the same influence of cold combined with it; but, whether it is or not, there is probably a general contraction of all blood-vessels having muscular coats, and this results in deranging digestion, assimilation, and especially interferes with the removal of

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\* Gross' Surgery, Vol. I, p. 771.

† Gross' Surgery, Vol. I, p. 772.

effete matter from the system. In cerebro-spinal meningitis there is frequently suppression of the urine. The bowels are sometimes constipated.

If the foregoing is a true view of tetanus and the action of ergot, we have in ergot of rye, wheat, and perhaps other fungi, something capable of acting toward the production of tetanus, and, in addition, of so interfering with digestion and excretion as to produce a depraved condition of the blood sufficient to account for the leading symptoms, if not for all the symptoms of cerebro-spinal meningitis. If these views are correct, the reason is plain why cold alone, a wound alone, or both together, do not cause all the phenomena of epidemic meningitis, for the production of which something is required which shall add the influence of those poisonous matters which in health are rapidly excreted from the body. They may enable us to see why when the disease occurs without the influence of cold some of the symptoms have been mistaken for typhus,—a disease due to animal poison in the system. They explain the reason why this disease is more frequent in cold weather, when the contraction of the blood-vessels of the surface is great through the influence of cold alone. They explain how the tension which occurs in fear, which is recognized as a factor in the causation of the disease, is capable of producing such an effect. They may throw some light upon other affections, as, for instance, tetanus, hydrophobia, cholera, intermittent fever, puerperal convulsions, and hysteria.

In order to prove that a disease is caused by a given substance or substances, agency or agencies, it is necessary to prove that the alleged cause is capable of producing the phenomena manifested by the disease, that it is present and acting whenever such disease occurs, and in order to fix upon one thing or agency alone, it must appear that no other known agency or substance capable of producing such phenomena is present and acting.

With more labor than will probably be realized by most persons who read the results, I have endeavored to collect all the evidence which was readily accessible to me relative to a number of substances and agencies, and to group it in such manner as that it should bear upon one of the three essential points just mentioned, and have its proper value in sustaining or breaking down the idea that each particular substance or agent was a cause of this disease. The results of several such groupings do not appear in this report, being considered of minor importance. That so much prominence is given to the subjects of cold and certain fungi, is because they seemed to be "true causes;" and, as regards the latter, a large amount of evidence has been given for the reason that it was believed that even then it would not by many be accepted as a prominent cause of the disease.

In some cases an effort has been made to show that it is not impossible that certain agencies and substances may cause the disease in question, and to offer a rational explanation of a possible method. This has been done partly for the purpose of removing obstacles to a complete and thorough collection of the evidence on the subject; for so long as people could "not understand how an excessive amount of ozone could possibly cause any such disease;" or "see no possible connection between cold and this disease," and conclude that "of course it is impossible that the disease could have been caused by that article of food,"\*—while we are so frequently met with such views as these, it is exceedingly difficult to collect any reliable evidence upon the subject.

More evidence seems desirable as to whether food containing ergot, or a

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\* Referring to flour made from smut wheat, "Providence Journal," R. I., Aug. 27th, 1874.



fungus having similar properties, has been used in communities where the disease has prevailed as an epidemic, and whether the particular persons who have had the disease ate of such food. Reference has been made to an unsuccessful effort to learn the conditions existing and the source and nature of the food supply at the Reform School in this State at the time the disease prevailed there in 1863-5. A communication was also addressed to the U. S. Minister at Paris, France, asking if it were possible to learn the nature of the crops in localities from which the French army were supplied in those years when it suffered so severely from this terrible disease. The reply of the secretary of the legation was as follows: "The French government has at length replied to my request for the information you wanted about smut in wheat. They regret that the long lapse of time since the dates referred to, prevents both the Minister of War, and the Minister of Agriculture, to whom application was made, from being able to answer your questions." But unless more attention is paid to such subjects in France than in the United States the lapse of time was a matter of no consequence, and no better result would have been reached if the inquiry had related to the year last past. The general prevalence of the disease throughout the United States during the year 1872 prompted a letter of inquiry to the Hon. Frederick Watts, Commissioner of Agriculture. The essential part of his reply was as follows: "The reports made to this Department do not mention smut in wheat in such detail as to enable us to state, with any approach to accuracy, the proportion of wheat so affected in any locality—nor even whether there was more or less of smut than usual in wheat, or other grain, in 1871." Until this time there seems to have been no demand for any such information. I made extraordinary efforts to obtain it for the reason that if it could be obtained in connection with past epidemics we need not go groping after this knowledge through numerous epidemics in the future. When the next epidemic comes it is to be hoped that the agriculturists will contribute to its study more definite knowledge respecting the disease, or absence of disease, affecting the principal crops which furnish us with food. But if they do not, it is possible that the chemists may give us the information sought. In the U. S. Dispensatory, on page 369 of the twelfth edition, is the following:

#### TEST FOR ERGOT IN FLOUR.

"The odor of ergot is no doubt owing to the liberation of its volatile alkaloid, probably in consequence of a slow decomposition of the native salt. A method of detecting ergot in a mixed powder, rye flour, for example, is thus afforded. If, on the addition of solution of potassa, the odor of ergot is perceived, its presence is sufficiently proved."

Since investigating the subject, I have had no opportunity of applying this test to flour known to have been actually used for food by a person suffering from this disease. Such a test applied to two samples of flour obtained from the Petersburg mill at the time of my visit, yielded negative or at least unsatisfactory results, as did also a similar test of two other suspected samples.

Microscopical examination of the flour has been suggested, and it may be possible that the mature spores of *Tilletia Caries*, the "bunt" of the English, and the kind of "smut" of this country which is found in wheat after it is threshed, may be found in flour made from such wheat, but I have never found any. It does not seem probable, however, that ergot of rye can be readily detected microscopically, for it contains nothing which is so very peculiar and

striking as to be easily identified in that manner, and if there is a real "ergot of wheat" it is probable that the same remark will apply to that.

In order to prove that this disease is caused mainly by any particular poison, it would be necessary to show that no other known poison capable of producing the disease is present and acting.

There are very many poisons which produce symptoms similar to those of cerebro-spinal meningitis, even to some of the *post-mortem* appearances; but in the results of most of these poisons there are certain points which distinguish the particular poison. Thus, in poisoning by strychnine there is trismus and opisthotonos, but there is also more violent tetanic action of most of the muscles of the body; there is no headache, nor, as a rule, vomiting; the *post-mortem* appearances include spinal congestion, but do not include evidences of inflammation, at least not in cases of rapid poisoning with large doses. In any search for a special poison capable of being the main cause of this disease, many such poisons can be thrown out as not present and acting. This is true of strychnia, of such fungi as might be mistaken for the edible mushrooms, and because of the prevalence of the disease in cold weather, of all poisons affecting green foods, except possibly such poisonous roots as may be mistaken for edible roots and preserved in cellars. There is one exception of the class last mentioned, but it is not one that appears to be capable of accounting for epidemics of this disease: In Taylor's *Prin. and Prac. of Med. Juris.* it is stated that persons have been poisoned by taking the roots of Monkshood (*Aconitum Napellus*) for those of horse-radish, these having been dug after the leaves had fallen. Horse-radish is frequently used at the season of the year when this disease prevails, but although the symptoms of poisoning by aconite are in some respects similar to those of the disease in question, there is no probability of its being the cause, for in this country the plant is not a very common one, and cases of the disease often occur in many different families at about the same time, and whatever external poison, if any, be found to cause the disease, it must evidently be one which, although having its distribution somewhat limited to certain localities, is so common to all classes of people in each locality as to have eluded observation up to this time. Cases of poisoning by mushrooms, by poisonous roots, by shell-fish, and even by cheese, are, probably, as a rule, detected, for the reason that not all the members of a family use such articles of food. The very fact that the cause of cerebro-spinal meningitis has not been discovered, is good evidence that it is not connected with any of the *secondary* articles of food. If connected with the food, the probabilities are greatly in favor of its being found in connection with the flour, for no other article of food is usually so distributed as to account for the distribution of the disease. Of all the poisons likely to be present in the flour, the one which is known to produce symptoms most like those of this disease is the fungus known as ergot. Other fungi are known to be poisonous, and are frequently found in articles of food prepared from the cereals.

Among the various poisons which are capable of producing symptoms somewhat similar to those of this disease is one which has been found in the food. On page 397, Vol. I., Taylor's *Prin. and Practice of Medical Jurisprudence*, the author says: "In January, 1854, Dr. Kingsley of Roscrea furnished me with the particulars of some cases in which several families, including about thirty persons, suffered severely from the effects of bread containing, by accidental admixture, the flour of darnel seeds." The symptoms exhibited, as described by Dr. Kingsley, were of a form of intoxication. There was giddi-

ness, tremblings of the arms and legs, impaired vision, coldness of the hands and feet, great prostration, and in some cases vomiting, burning heat in mouth and throat, confusion in head, and small and irregular pulse. There is no mention of lock-jaw or other tetanoid symptoms, as in cerebro-spinal meningitis, and the patients were convalescent on the following day, whereas in the disease in question convalescence is usually protracted. It is possible, however, that in small and long-continued doses the flour of the seeds of the bearded darnel may be capable of producing a form of poisoning similar to or even identical with cerebro-spinal meningitis. Inasmuch as it is certainly a dangerous poison, the characters of the plant should be well known to farmers in order that it may not, through ignorance of its dangerous qualities, be allowed to increase and eventually cause wide-spread poisoning by its admixture with the flour which enters into the constitution of so many of the ordinary articles of food. The botanical name of the bearded darnel is *Lolium Temulentum*. In Gray's Manual of Botany it is located in "Grain-fields, Massachusetts, and Penn: rare,—Grain noxious; almost the only such instance among grasses." It is an annual plant, "adventive from Europe." In a note the author remarks that "I here rank with the *adventive* plants those which De Candolle terms plants cultivated without or against man's will."\* As it has come across the ocean it seems probable that, unless effort is made to prevent it, it may spread still more easily throughout our own country.

There is one article which is now almost as widely distributed, and that is the potato. It will be referred to again in another place. Some of the phenomena of this disease might be accounted for if it could be shown that arsenic was so distributed as to be taken into the system, by persons throughout whole communities. I know of no evidence that the paris green, used to destroy potato-bugs, enters into the potatoes, or that it has ever been found in drinking-water from wells in the vicinity of its use; and this disease occurred long before its use for that purpose. Arsenical pigments have been in use for a long period of time, however, and are very largely distributed in dwellings, more especially on wall-papers and window-shades, but the effects of arsenic in that form are known, and do not correspond very closely with this disease, wherein the attack is quite frequently sudden.

Phosphorus is a very violent poison, even in minute doses, and its effects are sufficiently similar to the phenomena of this disease to demand thorough examination. In combination with other elements, it is found in many, if not in most, articles of food. If it shall appear that it is ever taken into the system in any such combination as will liberate it in a poisonous form, it will be worthy of serious attention. It is a component of nervous tissue, and, in health, it is excreted in considerable quantity, especially in the urine. It may be worthy of consideration in this connection that in cerebro-spinal meningitis there is frequently, if not generally, a scanty flow of urine, and it is possible that some of the secondary phenomena of the disease are due to the retention in the system of some of the combinations of phosphorus.

In a late medical periodical received while the first part of this report is passing through the press, I find a paragraph which bears upon this subject, and quote it with the remark that the statement needs confirmation:

"Professor Levi of the University of Pisa has just made known, as the result of numerous analytical and experimental researches, that the physiolog-

ical, therapeutical, and obstetric properties of ergot of rye are due to the presence of phosphoric acid, which it contains in abundance, much more than to its organic principles (like ergotin, ecbalin, etc.), to which until now had been exclusively ascribed all the various actions of the substance." \*

Those who have read this report thus far will have seen that the view which seems most reasonable to the writer of this report is that the disease in question is a tetanoid fever tending to cerebro-spinal meningitis if sufficiently prolonged; that it is caused by substances and agencies which cause excessive general muscular contraction, and which thereby produce excessive pressure throughout the blood-vessels of the body, causing, among other derangements, those blood-vessels to yield which are least well-supplied with strong muscular walls. This conclusion having reference more to a mechanism than to any particular poison or substance, it is not essential to exclude any substance or agent as a possible cause, but it is desirable to have evidence as to the possibility of producing such pathological conditions through such methods. After the greater part of this report and the conclusions at the close of it were written, and some part of it printed, the writer has fortunately been able to examine, somewhat hastily, the late work of Dr. H. C. Wood, of Philadelphia, on Therapeutics, and has inserted in different parts of this reports a few quotations. It seems that many observers have concluded that ergot must cause a rise of arterial pressure, and many experiments have confirmed this view. Dr. Wood says: "Seemingly the most elaborate and thorough examination yet made as to the action of ergot upon the blood-vessels, as evinced by its influence on arterial pressure, is that of P. Eberty (*Inaug. Dissert.*, Halle, 1873)." \* \* \* "He finds that the arterial pressure rises directly and enormously after the injection of ergotin. This rise, which he acknowledges to be chiefly due to the contraction of the vessels, occurs in the veins as well as in the arteries, and in the frog as well as in the dog and the rabbit." \* \* "Until further studies are made, no positive opinion can be arrived at as to whether ergotic vaso-motor spasm is peripheric or centric, but the probabilities seem to be very strong in favor of the latter origin." \* \* "The rise of arterial pressure produced by ergot, and the existence of vaso-motor spasm, must, I think, be considered as proven facts; yet Haudelin is stated to have found that the arterial pressure falls after the exhibition of the poison. Brown-Séquard has insisted (*Archives de Physiologie*, 1870, t. III., p. 434) that in ergotic poisoning there are two periods: first, vaso-motor spasm; second, vaso-motor paralysis. It is very possible that he is correct, and that Haudelin's results were simply due to his having used such enormous doses of ergot as at once to overpower the vaso-motor apparatus." †

The argument from successful treatment is one difficult to apply to this subject, for the reason that no treatment has been attended with much success. The same is true of tetanus. The following, from Dr. H. C. Wood's late work on Therapeutics, may serve as a starting-point, if the view proposed in this report as to the mechanism of the production of cerebro-spinal meningitis and of tetanus is deemed worthy of examination. On page 302, speaking of nitrite of amyl, Dr. Wood says: "Its physiological action would indicate that it should be of service in all cases of spasm of the capillaries, of the bronchial tubes, and of the muscular system generally." On the page following, for quite other reasons, however, he suggests its use in tetanus, and says: "It has

\* Medical and Surgical Reporter, Phila. Feb. 20, 1873, p. 158.

† *Materia Medica and Toxicology*, p. 468-4.

been used, so far as I know, in only two cases (London Lancet, 1871), both of which recovered, one with the amyl salt alone, and the other with it and chloral."

It may be added that in cerebro-spinal meningitis hot baths and hot applications to the surface have been frequently recommended as useful, especially in the beginning of the disease.

It was hardly to have been expected that in this first attempt it would be possible for the writer to demonstrate the cause of this disease which has been the subject of more or less study for a century. If he has succeeded in contributing in any degree to the advancement of our knowledge of its cause, or in clearing the ground and laying out work which shall advance it, the labor will be well repaid.

What are some of the questions believed to have been now or previously answered, and what are those to which answers are still wanted? It is probable that this would elicit a different reply from different persons. Answering only for myself, I conclude that: 1. There does not seem to be sufficient evidence to prove that the disease is contagious, in the ordinary sense of the term. 2. I am not satisfied that it has a general atmospheric cause. 3. It does not seem probable that epidemics of this disease are caused by over-crowding, imperfect ventilation, bad drainage or sewerage, or by any of the ordinary unsanitary conditions acting alone, although the death-rate may undoubtedly be increased thereby when the disease occurs under such conditions. 4. Observations are much needed to show what relation, if any, exists between the presence of ozone in the atmosphere and the prevalence of this disease, as also between extreme dryness of the atmosphere and this disease. 5. The exact constitution of the drinking water should be ascertained; and any evidence going to show that it is materially changed in winter or spring might bear upon the study of the cause of this disease. 6. An important question remains to be studied as to what relation, if any, exists between this disease and those plants which yield solanine, more particularly the common potato. An epidemic of a disease manifesting many symptoms common to the one in question, was attributed to poisonous exhalations from a mass of decomposing potatoes collected at a starch factory. Cases of poisoning by sprouted potatoes are on record. This disease frequently occurs in spring, at which season potatoes have frequently undergone one or the other of these changes referred to above. 7. Another subject which deserves study in connection with this disease, is the possibility of the introduction into or the retention in the system of an injurious amount of phosphorus or some of its combinations, as that substance is poisonous in exceedingly small quantities, and some of the phenomena attendant thereon are suggestive of this disease. Possibly this may be accounted for by the fact of the retention of urine, and of other excretions, in this disease, and therefore of the phosphates which in health are rapidly excreted. 8. It is not probable that epidemic cerebro-spinal meningitis is entirely due to a single cause; and as a rule at the present time it is only wide-spread when several causes acting in the same general direction are equally wide-spread and combine to render it epidemic. 9. To specify the prominent causes, I conclude that, as regards season of year, which has been known to have some close relation to this disease, it is probable that cold and reaction therefrom are the principal controlling elements, and that cold is one of the causes of this disease. As regards ergot, smut, and all fungi which cause great contraction of non-striated muscles, they are probably capable of being prominent causes of this disease, and further evidence is

very desirable as to the precise changes which they induce in the human body and which appear *post-mortem*, in order to enable us to determine the above proposition, as also whether epidemics of this disease usually owe their violence in great degree to the presence of such substances in the food. 10. Fear is doubtless capable of contributing to its causation; as is also, physical pain, mental anxiety, and, perhaps, undue mental labor. 11. The recumbent position of the body, as in sleep (and perhaps the condition of sleep), favors the production of the disease, so far as relates to general congestion of the brain and spinal cord, for the reason that whereas in the upright position the force of gravity favors the return of venous blood from the brain and spinal cord, in lying down the force of gravity does not act to prevent excessive pressure upon the blood vessels throughout the body from forcing the blood into the veins of the brain and spinal cord, which are not provided with valves; and, the muscular coats of the cerebro-spinal arteries being thin, there is then a tendency toward their undue distension.

To summarize and state in general terms the conclusions reached.—it is extremely probable, but not yet proved, that any substance or agency which causes unusual contraction of the non-striated muscular tissue throughout the body is capable of being a prominent cause, and any substance, agent, bodily position, condition, sensation, or emotion, which tends to produce general muscular tension, or otherwise to force unduly the blood into the blood-vessels of the brain and spinal cord, is capable of contributing to the production of this disease.

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NOTE.—As the writer has been directed to continue this investigation, he will be duly grateful for any material evidence relating to the subject which it may be convenient for any person to place in his possession.

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ERRATA: On page 134, the reference mark after "ill-ventilation" should be a star, and after the word "poison" a dagger. On page 137, line 21, read 35.6 instead of 356, and in line 22 read 101.9 instead of 1019. On page 142, line 22, read Schönleinii instead of Schonleinu. On page 165, tenth line from bottom, read "flexure of forearm on arm."



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THE METEOROLOGY OF CENTRAL  
MICHIGAN.

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*A Lecture delivered before the Students of the State Agricultural  
College, Oct. 21, 1874.*

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BY R. C. KEDZIE.

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## THE METEOROLOGY OF CENTRAL MICHIGAN.

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The meteorology of Central Michigan may seem a subject unsuited to a public lecture, yet is a matter of vital importance to the inhabitants of this region, for the meteorology of any country involves questions relating to life, health, physical development, and worldly prosperity.

To many persons the objects and aims of meteorology seem unimportant, if not frivolous. They will ask, What is more unstable than the wind? that "bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh, or whither it goeth." What good can come from watching the ever-changing clouds, marking the capricious rain-fall, or noting the fluctuating temperature of any place? Will it give us rain, keep off frost, increase our crops, and ward off sickness and death?

I answer that the object of meteorology is not to change the usual order of nature, but to observe and record the action of the forces which make up climate, from which observations may be deduced the maxims and laws which should control our actions when living in such a climate. We best conform to nature when we know her laws, for by a knowledge of these laws we may cause her to sustain to us the two-fold office of servant and friend. Nature is a true friend, a faithful servant, but a hard mistress; but she is the tyrannical mistress only of the ignorant and unthinking.

In this study we must use method and order to reach valuable results. There is a way of observing such natural phenomena which will not conduce to such results, and this is well described by the Hebrew Poet, Philosopher, and King, more than 28 centuries ago: "He that observeth the wind shall not sow; and he that regardeth the clouds shall not reap." Solomon never scientifically studied meteorology!

The meteorology of any place is of scientific interest because by it we evoke from the capriciousness of nature, fixed order and law. Few things give more real pleasure to a thoughtful mind than thus to bring order out of apparent confusion, resolving the apparent discords of fact into the harmony of truth.

Meteorology is of practical value from its relations to the agriculture and the health of any region.

### METEOROLOGY LIMITS AGRICULTURE.

The agricultural capabilities of a country can only be known by a comprehensive knowledge of its meteorology. The climate of any place is too widespread in its influence and far-reaching in its results for man to successfully cope with it on the large scale in agriculture. If we want to know whether any country is adapted to the growth of any given crop, we must know the temperature of the seasons, the time of cessation of frosts in spring and of

their advent in autumn; the amount and distribution of rainfall, the sharpness of the curve of summer heat, etc. We may arrive at these results in two ways, by meteorological observations, or by the direct effort to produce the crops themselves. The latter is the most usual way employed, and thousands of acres are devoted to the growth of crops, often giving no return but disaster and ruin to the unfortunate experimenters. In the settlement of new countries the pioneer farmer anticipates by years the pioneer scientist, but if we could reverse this order and determine in advance by scientific observation what are the climatic capabilities of any country, great suffering and bitter disappointment might be saved to those who are least able to bear them. The General Government is preparing to open to settlement a vast region to the northwest, and it is being staked off by the surveyor into townships and sections for the use of the settlers. If the government would in advance of any settlement, by a careful system of meteorological observations, determine its agricultural capabilities, whether adapted only to grass, and hence essentially fitted for stock-raising, or capable of producing grain, and especially the prince of American grains, Indian corn, or fitted for the production of any or all kinds of fruit, it would show a paternal care for the welfare of the hardy but poor emigrant worthy of all praise.

But meteorological observations, to be reliable in deciding such questions, must descend to minute particulars. The mean annual temperature of any place does not determine its agricultural capabilities. For examples: According to Dové the mean annual temperature of Ireland equals that of Southern Michigan, but while the camelia (with us a glass-house plant) will grow throughout the year in Ireland, the summer heat is insufficient to ripen plums; and Indian corn will not ripen in the British Islands, though they have a mean annual temperature equal to that of our most noted corn-producing States.

#### METEOROLOGY AND FRUIT-CULTURE.

But meteorology is of value not only in telling us what we cannot grow, but also in informing us what we may successfully cultivate. For example, take the meteorology of our own State, so singularly modified by the vast U of lakes which inclose it on three sides. Meteorology had already announced the singular influence of water in mitigating extreme fluctuations of temperature. But this by itself would lead us to suppose that proximity to large bodies of water was all that is necessary, and hence the region bordering on the western shore of Lake Huron should receive the same benefits as that lying along the eastern shore of Lake Michigan. But meteorology goes farther: it shows that the prevailing winds of this latitude are from west and southwest: hence the winds of the Huron border of our State are from the land, and subject to the extremes of the land climate, both in temperature and moisture, while the prevailing winds of our western lake border have swept "this unsalted sea," modified in temperature, loaded with moisture which it deposits in the heavy snow-fall of the winter, and hence the sharpness of winter climate is broken by two powerful forces, precipitation of watery vapor liberating heat, and the protecting influence of the blanket of snow saving excessive loss of heat. If meteorological observations had been made in that region the first time that the white man entered our State, they would have unmistakably pointed out the preëminent fitness of our western border to produce fruit. Instead of now just beginning to develop the natural capabilities of this singularly favored

belt, we might 50 years ago have made this the garden border of the West. Who shall say that the people of our State have not failed of a certain degree of physical development which they would have secured with an abundant supply of the luscious fruits which flourish all along our wave-washed border? In matters of money we can all see that we have lost millions of dollars by failing to develop these resources which meteorology would have at once brought to our notice. We often hear the practical man and the theoretical man spoken of as utterly dissimilar, but we now see that they may meet and shake hands across a line which fulfills the definition of a mathematical line, viz.: extension, without breadth or thickness.

An animated discussion has arisen among scientific men whether the forests have any influence on climate, and especially on rain-fall. There was a fine opportunity to settle this question in this forest State of the North, if only we had the meteorological observations to decide it, but unfortunately these observations are wanting. We have indeed some measure of the conditions of climate, by which the total results of years may be compared. The geologist endeavors to estimate the conditions of life in pre-historic times by the nature and distribution of the remains of animals and plants. We shiver as he tells of the ice epoch, with glaciers covering the continent, or of icy seas with their vast fleets of crashing icebergs, or we flush with heat as he tells of the torrid heat that followed. But he has no measure of time for all these changes, and is as prodigal of his thousands of years as a spendthrift of his promises to pay. With us the case is different. We have for the past 150 years an approximate measure of climate by the vegetable force revealed in the consecutive rings which mark the yearly growth of the tree, and an accurate measure of time in the number of these rings. These rings are a measure of the force of vegetable life which is so immediately dependent on climate. Make a cross section of any tree, and count the rings from the heart to the bark, and you have the number of years of the life of the tree; the thickness of each ring marks the vigor of growth for that year, and this indirectly measures the climatic conditions of that year. The rings are a diary, or rather an *annuary* of the life of the tree. This thick and strong ring tells of a year of plenty,—of abundant rains, warm sunshine, and all the conditions of vigorous vegetable life; this thin ring tells of pinching want,—scanty rain, cold weather, and poverty of vegetable growth. The rings are the *annals* of the tree, the history of its growth in the order of years,—the measure of the sunshine and the rain as they affected vegetable life from budding spring-time to the disleafing of autumn. By counting from the bark inward we may determine what years in the past were favorable or unfavorable as we thus pass in review the years that have fled.

#### MEDICAL CLIMATOLOGY.

Medical climatology is almost unknown. We know, indeed, that climate has a marked influence in causing or curing disease. It is a matter of daily observation that persons change their climate in hopes to recover health. A physician of unusual intelligence told me of a patient residing in Massachusetts who suffered from asthma in a severe form, and the doctor prescribed for him a residence in Michigan, which resulted in complete cure. This same man, after his recovery, brought another asthmatic, a resident of Michigan, to the doctor, and asked what should he do? The doctor sent *him to Massachusetts*, where he found a cure. Such cases are not governed by caprice. The differences in the climate of Michigan and of Massachusetts, and the

marked differences found in what passes for the same disease, explain the apparent anomalies of the case.

But when the question comes up what climate will certainly benefit any given patient, we are often left to grope our way in the dark, because we know so little of the meteorology of our vast country. With a complete knowledge of our meteorology we obtain an important datum for deciding such questions. The time will come when the physician examining a patient, instead of prescribing the two Ks, calomel and quinine, will order so many months in Virginia or Minnesota, or so many winters in Florida or California. But let a person be attacked with some serious disease like consumption, and ask the advice of any half dozed of physicians even of eminence in their profession, and he will learn from their conflicting advice how little is *known* on this subject. One says go East, another go South, go North, go West. We hurry our friend to one place only to find the climate does not agree; we hasten elsewhere only to find we have made a worse mistake, and at last we bring back our sad but precious burden, and "dust to dust, ashes to ashes" closes the scene!

The first step in establishing a medical climatology is a thorough knowledge of the meteorology of our country. This will involve a masterly acquaintance with all the meteorological agencies which influence the animal organization, as well as those which make up the climate. In our vast borders we have all the known conditions of climate, both meteorological and medical, and in this vast range will yet be found the conditions suited to the recovery of all forms of disease. But these can be found only by patient, plodding work with barometer, psychrometer, rain-gauge, wind-vane, test-papers, etc. For this purpose an army of observers is needed, while we have only here and there a solitary sentinel.

As a small contribution to this desirable result I present some of the leading features of the climate at the State Agricultural College, derived from ten years' observation.

The average height of the barometer, reduced to temp. of 32 deg. is 29.00 inches. This indicates an elevation of about 700 feet above the sea level.

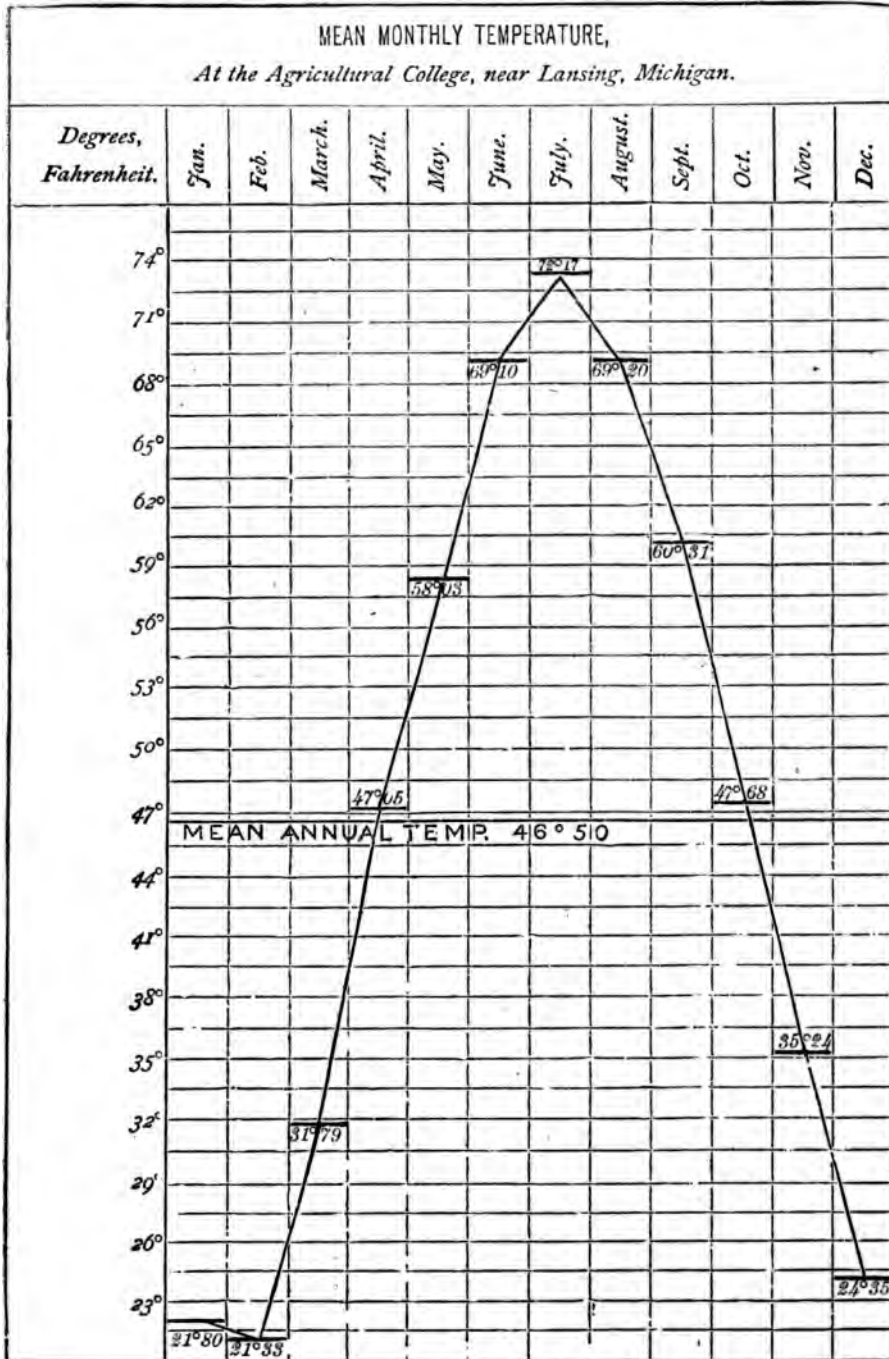
The mean temperature for the year is 46.5 deg. The range of temp. observed is from -32 deg. to 101 deg., or an extreme range of 133 deg. The mean temp. of the months, as shown by Diagram 1, shows that we have the wide range of temp. which is characteristic of the land climate. The warmest month, July, has a temp. of 72.17 deg.; the coldest month, January, 21.8 deg.; the mean range of the months is 50.37 deg. The temp. of April, 47.05 deg., differs from the mean annual temp. by about one-half of a degree, while that of October exceeds the mean annual temp. by about one degree. Our climate, therefore, complies with the usual rule laid down by Loomis, viz., that the mean temp. of April and October is nearly the mean temp. of the year.

The lakes which clasp our borders have but little direct influence in controlling the extremes of temp. at Lansing.

#### CLOUD AND SUNSHINE.

We are apt to look upon the clouds simply as the carriers of water and the sun as the giver of heat, and that both clouds and sunshine have reference only to vegetable life; but they have relations scarcely less important to animal life. It has been found by direct investigation that there is a marked difference in the health, vigor, and length of life in favor of persons who inhabit

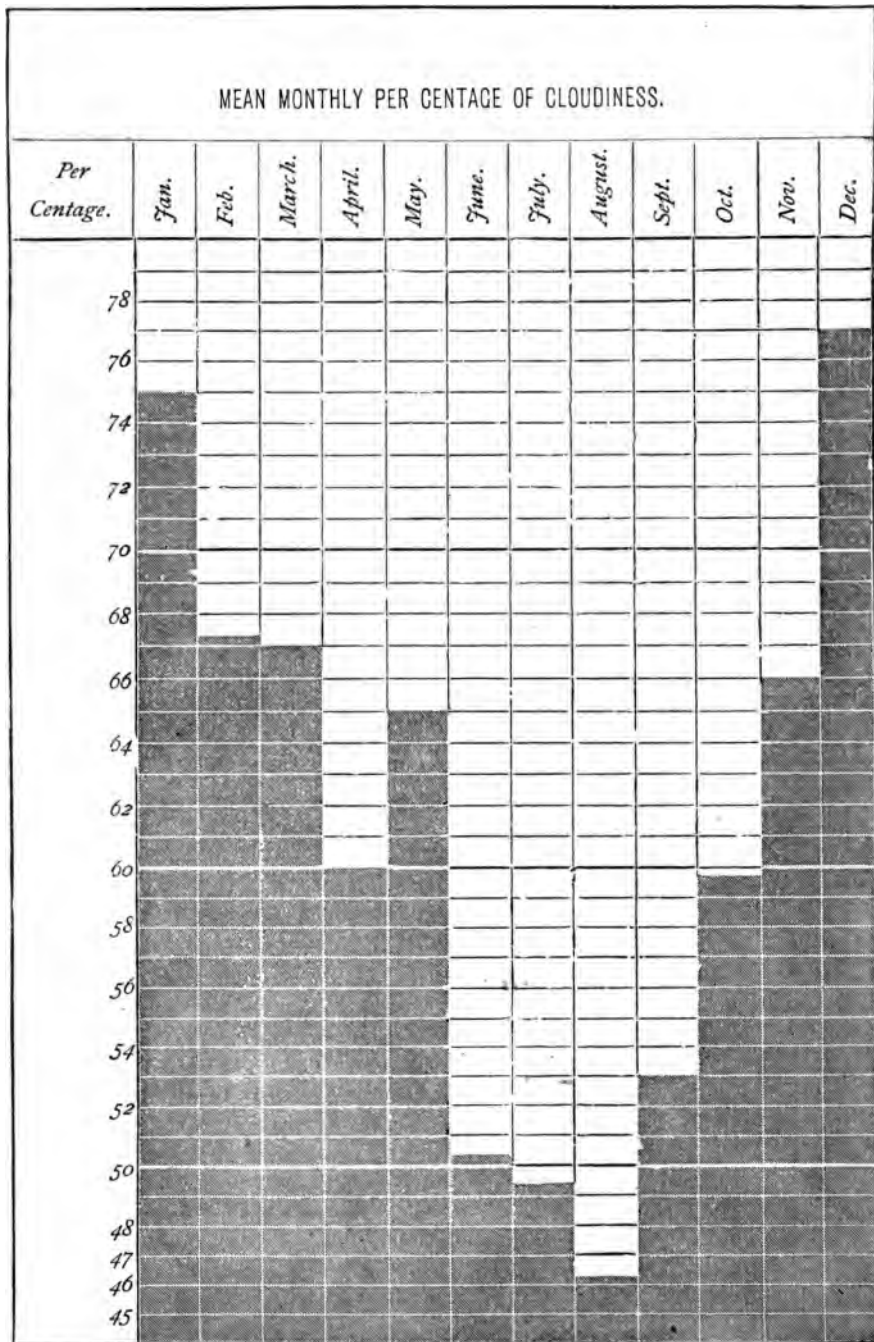
# DIAGRAM NO. 1.



Designed by R. C. Kedsie.



## DIAGRAM No. 2.

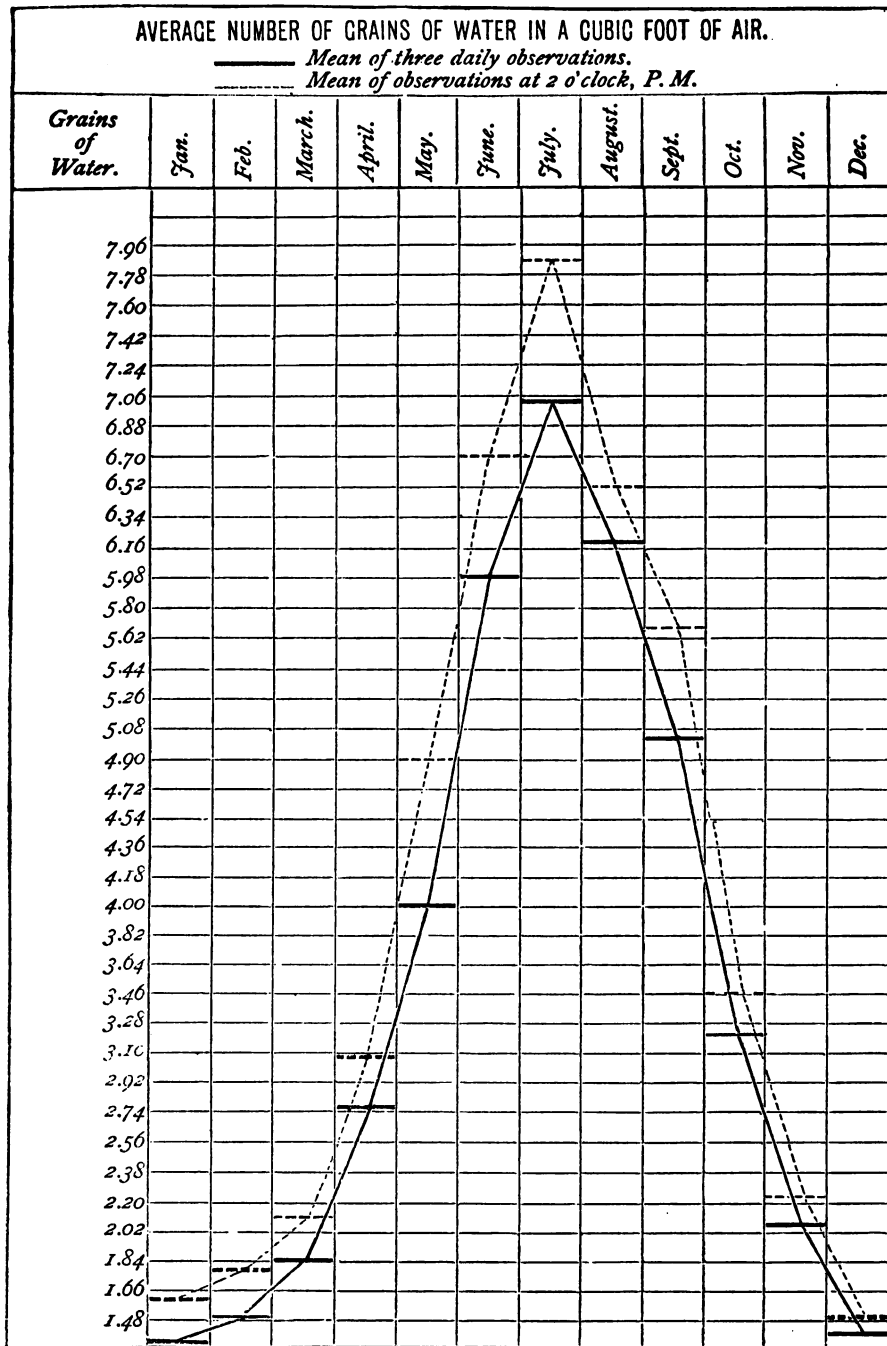


*Designed by R. C. Kedzie.*





# DIAGRAM No. 3.

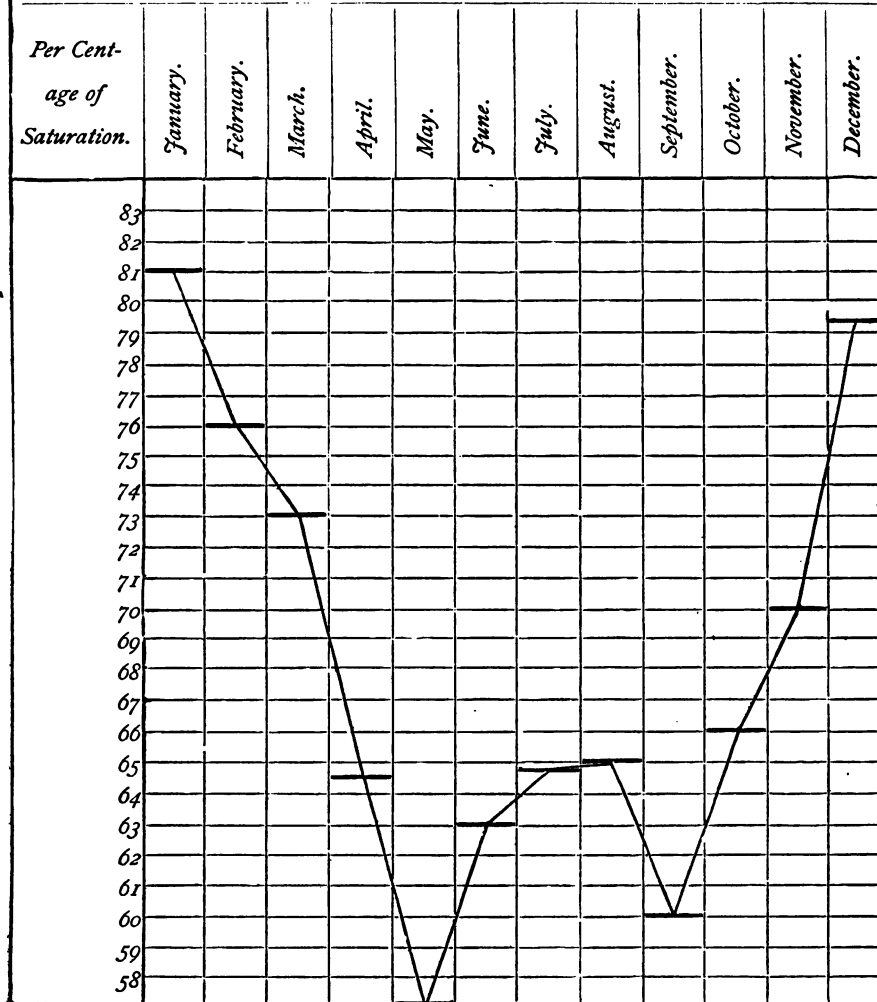


Designed by R. C. Kedzie.



## DIAGRAM NO. 4.

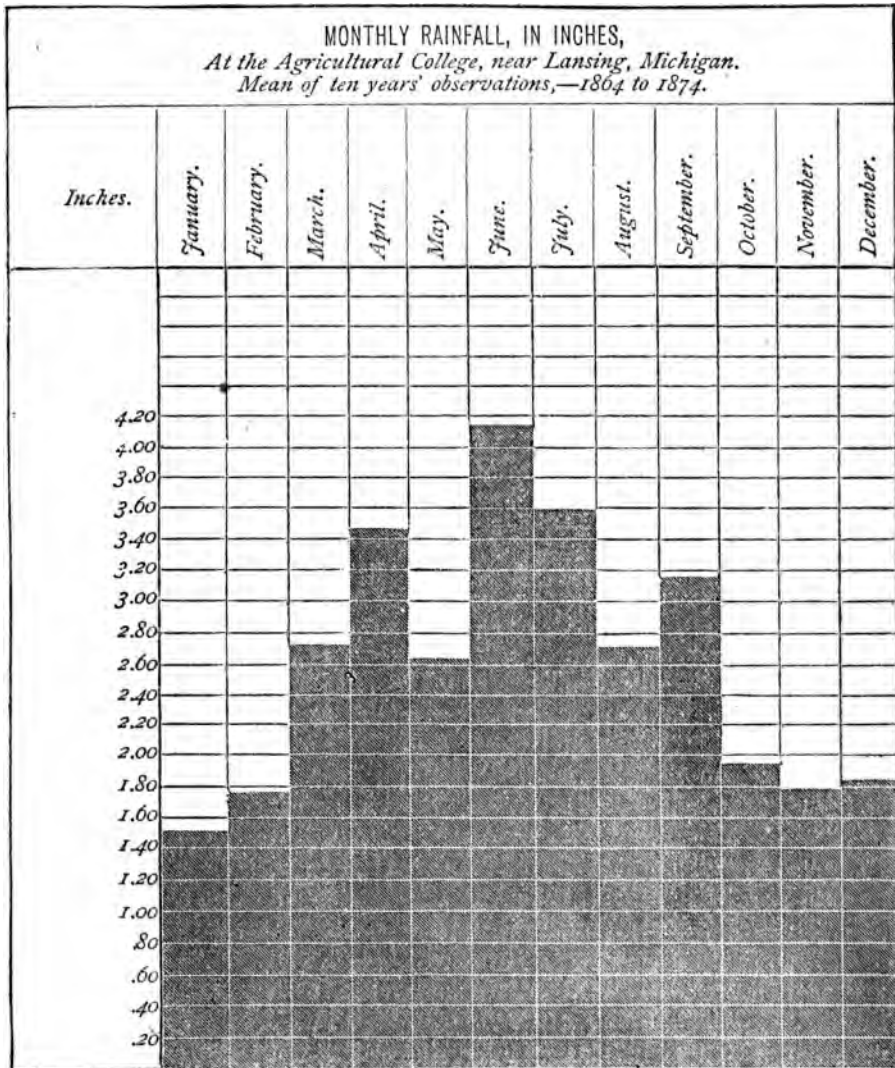
MEAN MONTHLY PER CENTAGE OF SATURATION OF THE AIR WITH WATERY VAPOR,  
*at 2 P.M.*



*Designed by R. C. Kedzie.*



## DIAGRAM NO. 5.



*Designed by R. C. Kedzie.*

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the sunny side of a house over those who inhabit the shady side. The same will be found to be true of those who live in a sunny climate. I have often observed that a prolonged period of cloudy weather tells upon the health of a whole people. When such periods of gloom come on, when the sun does not shine out clear and strong for weeks, the sick are sicker, the well feel indisposed. Men are soured by the darkness, and keep their rooms, or pass each other in moody silence when they meet on the street. But let a bright sunshiny day come and all is changed; everybody is out of doors to bathe in the sunshine, and every man greets his neighbor with a pleasant word. What is true of short and exceptional periods is still more true when such characteristics of cloud or sunshine make a leading feature in climate. Contrast the surly John Bull of cloud-wrapped England with the mercurial monsieur of sunny France.

The proportion of clear days to cloudy is therefore an important element in the medical climatology of any place. The proportion of cloud and sunshine in this place I have given in Diagram 2, and the characteristics of the months in this important feature. December is the month of cloudy gloom, and July leads the sunny train.

#### MOISTURE.

The most striking feature of our climate arises from its relations to atmospheric moisture. Our climate is dry. Notwithstanding we have an annual rainfall of  $30\frac{1}{2}$  inches, yet so rapid is evaporation that our climate is distinguished by its extreme dryness. In Diagram 3 I have given you a graphic representation of the number of grains of water held in each cubic foot of air for each month of the year; also the number of grains in each cubic foot of air at 2 P. M., and the amount seems large. But when we turn to Diagram 4 and look at the percentage of saturation at 2 P. M. for each month, we get some idea of the remarkable dryness of our days. Occasionally this disparity between the amount of water actually present and that which the air is capable of holding becomes enormous. Thus the temp. observed on two occasions this year was 42 deg. above dew point.

The distribution of rain and melted snow through the months of the year is given in Diagram 5. June is our rainiest month, and February has the least precipitation.

I have already said that we are too apt to look upon the atmospheric moisture solely with reference to its relations to vegetable life; as giving us abundant or scanty harvests, and influencing animal life only indirectly through its relation to the food supply. But its relations to animal life are not thus restricted, for its relations to sentient life are of the most profound nature. These relations make or destroy national life; they limit and control races of men, and by their ceaseless activity are potent agencies in shaping human destiny.

Guyot, in *Earth and Man*, gives a graphic contrast between the moist and cool climate (watery) and the dry and extreme climate (land climate). He says: "The watery climate favors the growth of an abundant vegetation, with large and numerous leaves, and with but little variety. The animal world is still more limited. All the larger animals are wanting, and the influence of this soft and moist climate makes itself felt by a relaxation of the tissues, and by a general want of tone in the system. The inhabitants of the islands in



mid-ocean always exhibit the mild, facile, and careless character which seems to be the necessary result of such a climate.

"The land climate does not give to the vegetation an appearance of such exuberance, but the dryer and warmer air concentrates the vegetable saps, elaborates them better, and gives them that strong and aromatic character which the plants of the oceanic islands rarely possess. The animal is more vigorous and larger in the land climate, the species more varied. Man himself is more animated, more active, more intelligent, and endowed with a stronger will. In a word, life is more intense, and raised to a higher degree by the variety impressed upon it by the contrasts that form the very essence of the nature of this climate."

If it seems to you that the influence of climate is entirely subordinate in the formation of individual characteristics, and in the moulding of national life, take the physical condition of Michigan and of Holland, having nearly the same mean temperature, but differing greatly in humidity, and compare the Dutchman with the Wolverine. You may object that they are of different races, but we are more nearly connected with the Dutch by blood and race affinities than any other nationality except the English; we, like the Dutch, are a branch of the great Teutonic race, for the Saxon is the best element in English blood. While difference of race will not account for this variation in national characteristics, the difference in climate will go far to explain them. I will not bring before you all the illustrations of the marked influence of the climate of Holland, but will content myself with one. It is customary in Holland to bake at one time the bread to supply the family for two weeks. Think of our eating bread two weeks old! Yet in that moist climate there is no difficulty in keeping bread in a palatable condition for so long a time. A difference in climate so marked as this must leave its mark on animal life also.

Climatic influences may, at first sight, seem feeble to produce a marked influence on animal life; but we must remember how persistent is its action which "pauses not for matin or for vespers, for noon of day or noon of night." It is a cumulative force, causing certain changes in one generation which reappear in full force in the next generation, to be still more augmented in each succeeding generation. Mark the raw Dutchman as he comes to our State, and notice how different are his children, and still more changed his grandchildren. A certain quality of the native character still holds on, but how changed is its manifestation; there is less phlegm and more vivacity; the increased sprightliness and augmented nervous force tell of a mighty change. You may claim that this is the result of our institutions, of our political and social life, and above all, of our educational system. Politics I regard as the feeblest of all our developing forces. It is an educator of low power. It may excite ambition, and thus tend to arouse, but as a direct educator it is of small account. Far otherwise is our educational system. But what has given us the educational system which has placed us in the van of all the Western States? Is it not the clearness of thought, the force and energy of character, the indirect products of climate, which enable us to see the need of such training, and point out the means of its attainment? The educational system of our State may be considered as truly a product of our climate, as are our vegetable productions. Language will not explain it. Race will not explain it, else all the States of our Union would be on the same plane with us. But when we come to climate, we find there are zones of social and intellectual life as strongly marked as the isothermals of the meteorologist. Compare the average Michi-

gan man with the inhabitants of southern Ohio and Indiana, the Virginian and Texan.

Climate is to be judged as much by its fauna as its flora. If we sometimes complain of the meteorological conditions which stand in the way of securing the best agricultural results, we may remember with gratitude that these same conditions have given the people of this State a development of manhood of which we may well be proud. It shows a compensation for evil which everywhere marks the works of Him who "maketh the outgoings of the evening and of the morning to rejoice."



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